

**NASA CR-174665
84SRD006**

EFFECTS OF VANE/BLADE RATIO AND SPACING ON FAN NOISE

Volume II—Data Supplement 3

**by
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and
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**NASA-Lewis Research Center
Contract NAS3-22062**

**(NASA-CR-174665) EFFECTS OF VANE/BLADE
RATIO AND SPACING ON FAN NOISE. VOLUME 2:
DATA SUPPLEMENT Final Report (General
Electric Co.) 359 F 4C A16/MF A01 CSCI 20A**

N65-15792

**Unclas
G3/71 14262**

NASA V/B RATIO
SPACING PROGRAM

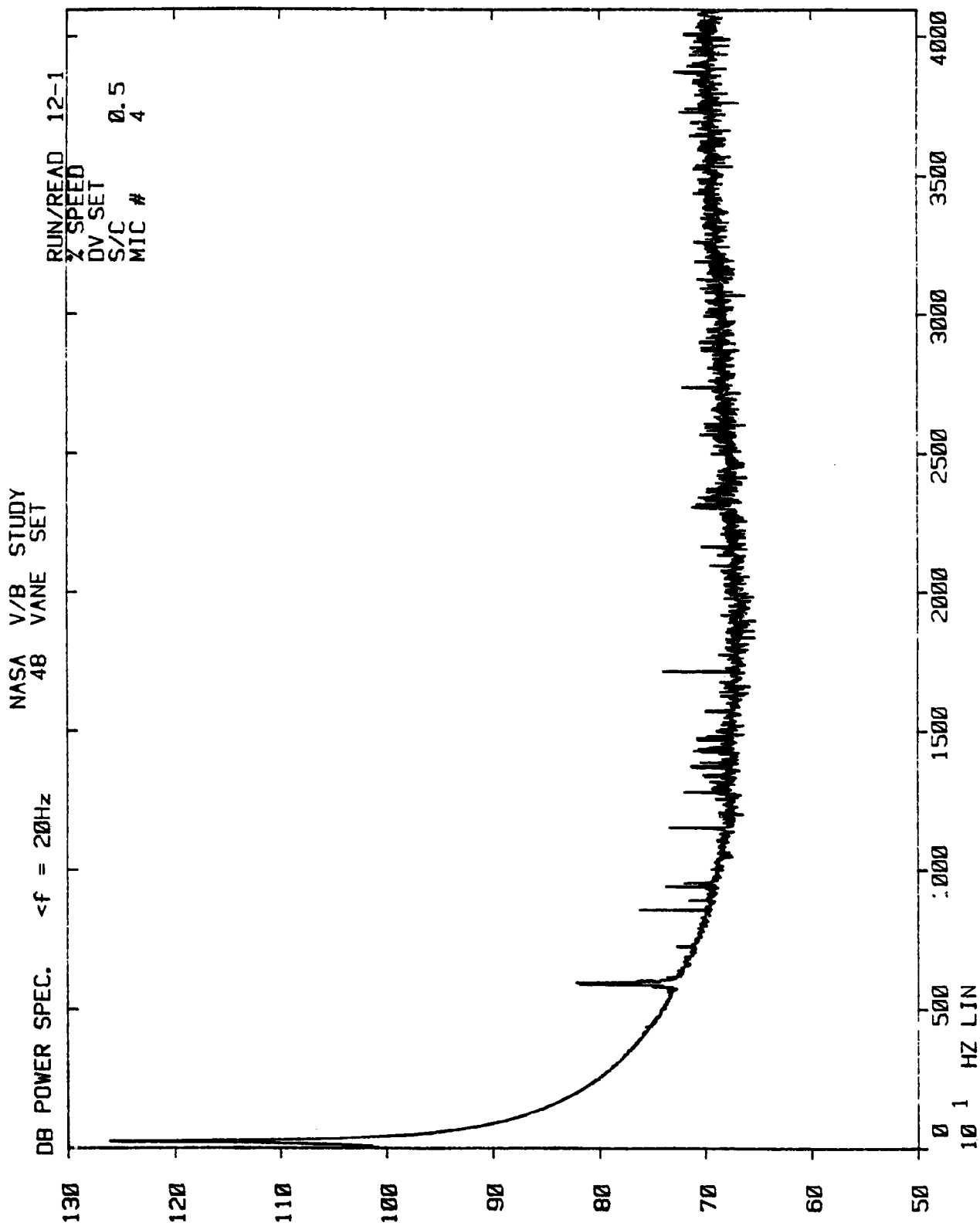
48-VANE N/Bs

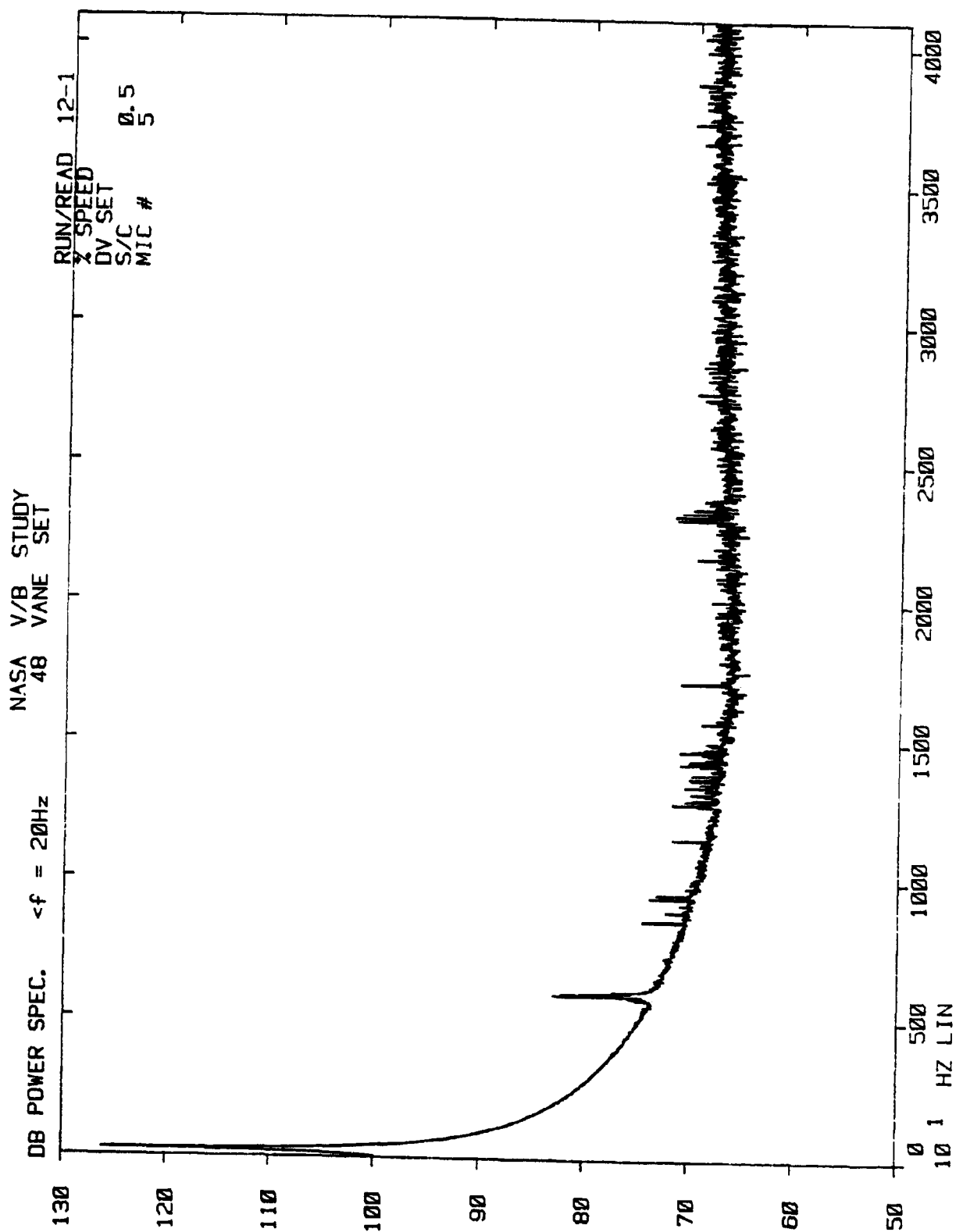
NARROW BAND SPECTRA (20 Hz.)

MICROPHONES 4-7 (30° - 60°)

• 48 VANES, S/C = 0.5

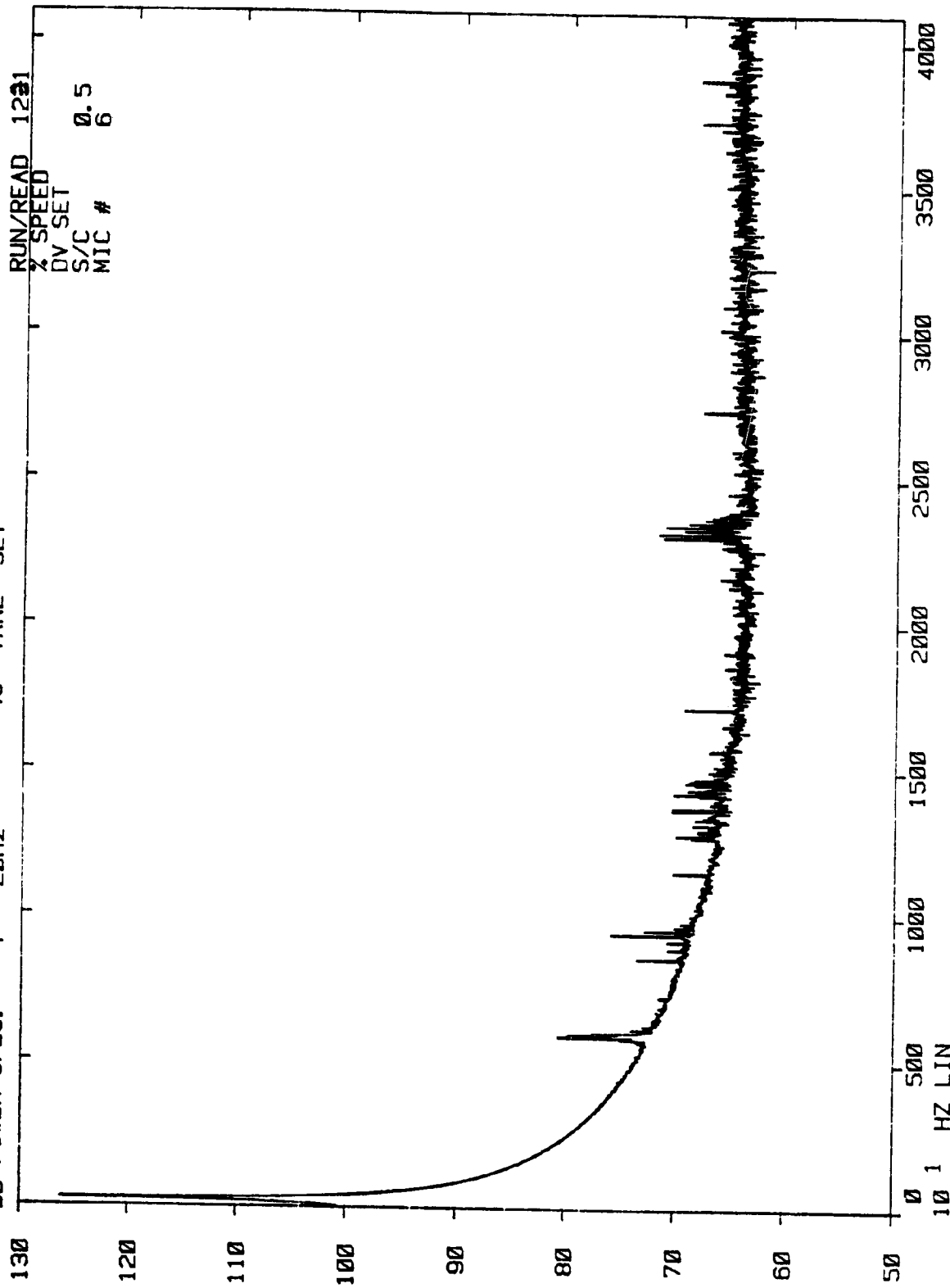
<u>RUN/RD6.</u>	<u>%NF</u>	<u>DV</u>	<u>REMARKS</u>
12/1	0	0	BACKGROUND NOISE CHECK
12/31	54	1.35	
12/29	63	0.88	
12/28	63	1.35	
12/26	69	0.88	
12/27	69	1.35	
12/25	76	0.88	
12/24	76	1.35	
12/22	80	0.88	
12/23	80	1.35	
12/21	86	0.88	
12/20	86	1.35	
12/18	95	0.88	
12/19	95	1.35	
12/17	100	0.88	



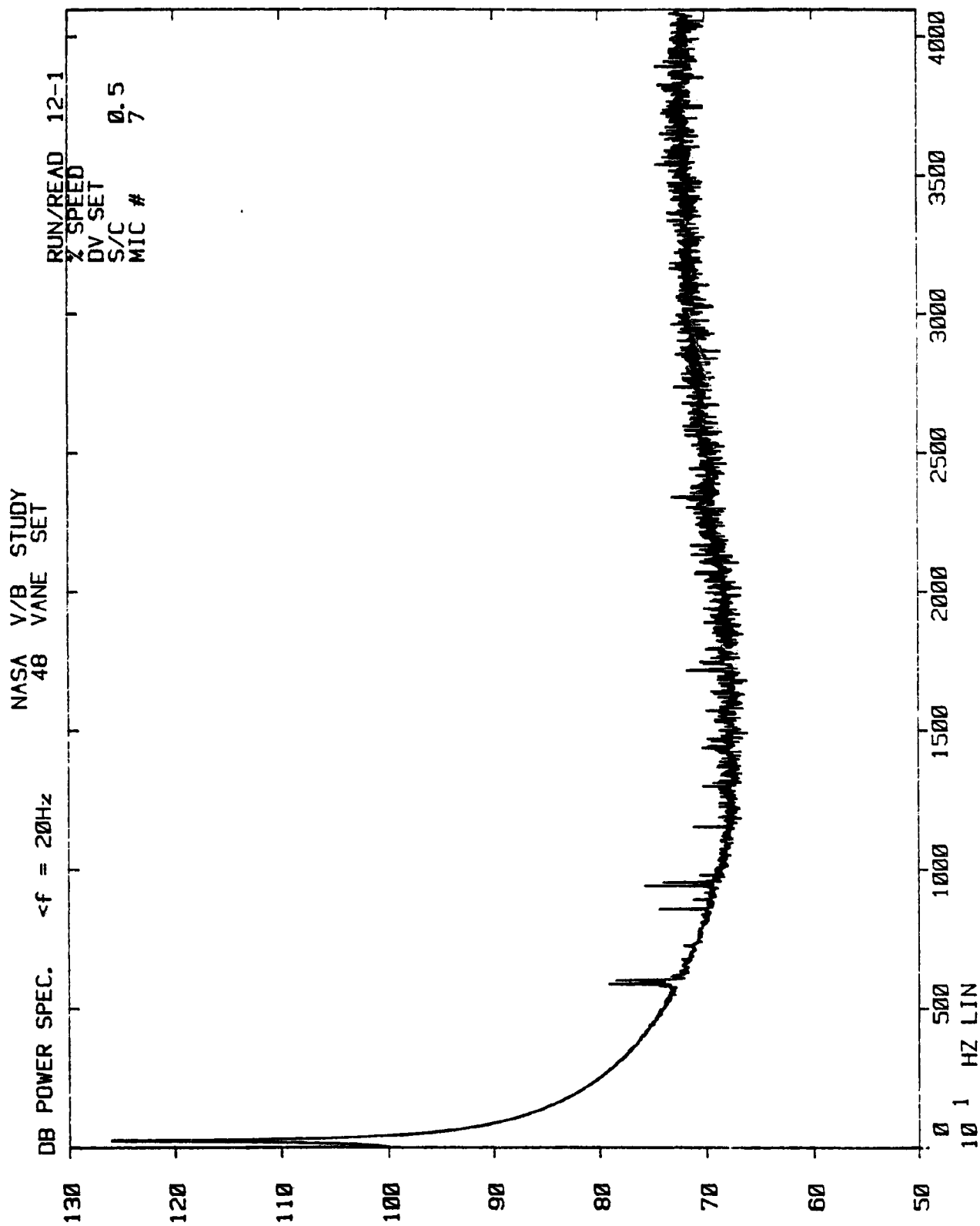


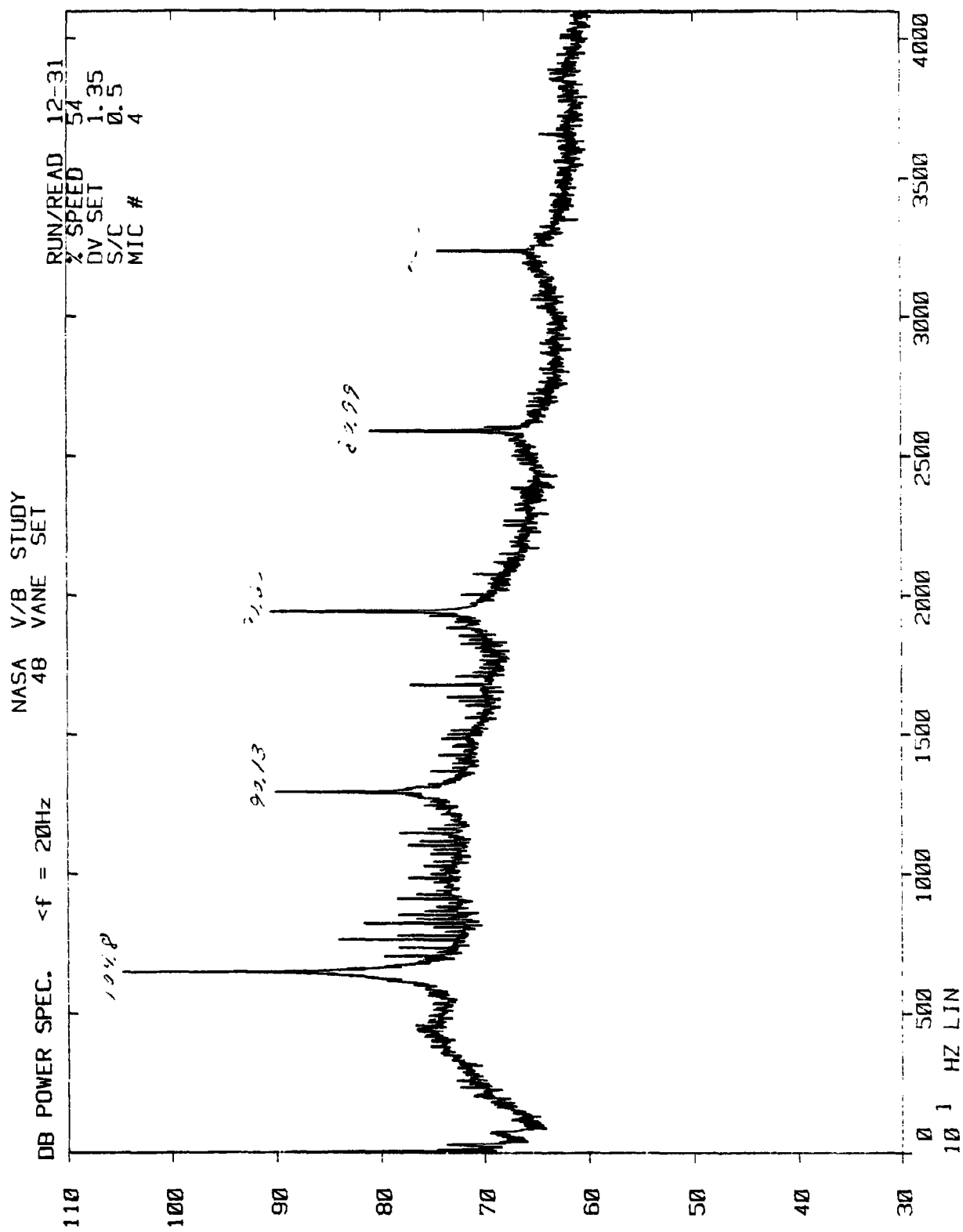
NASA V/B STUDY
48 VANE SET

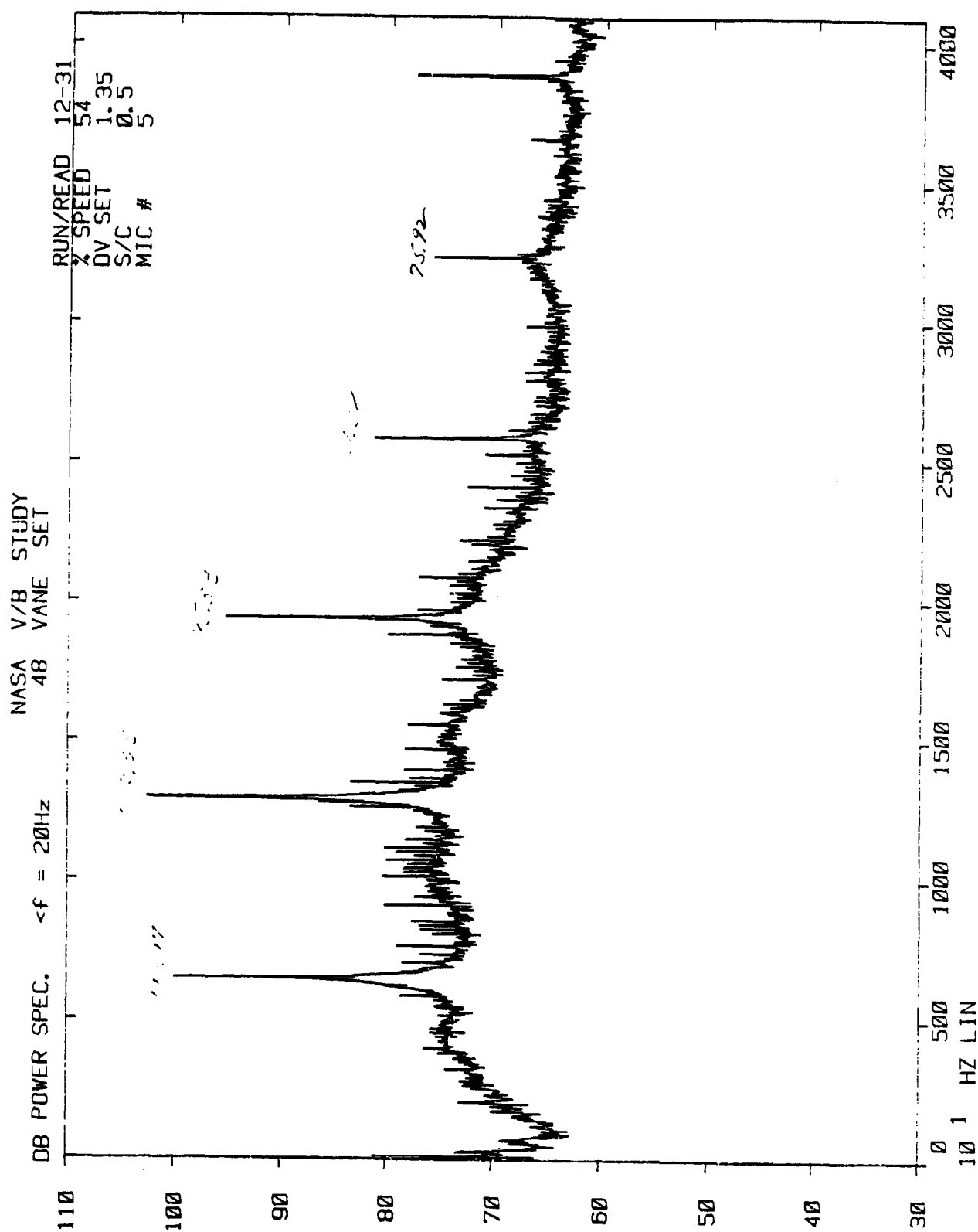
DB POWER SPEC. $<f = 20\text{Hz}$

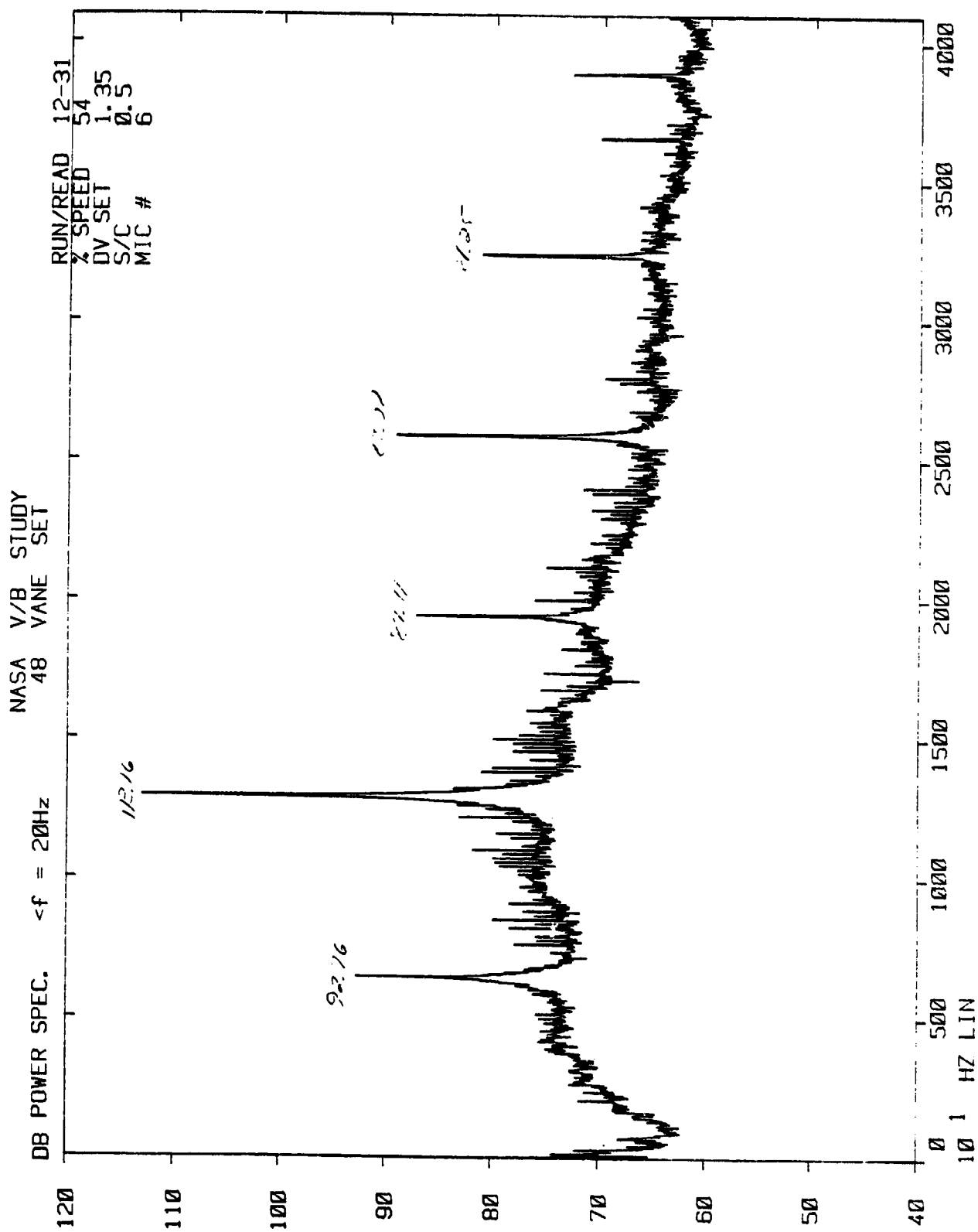


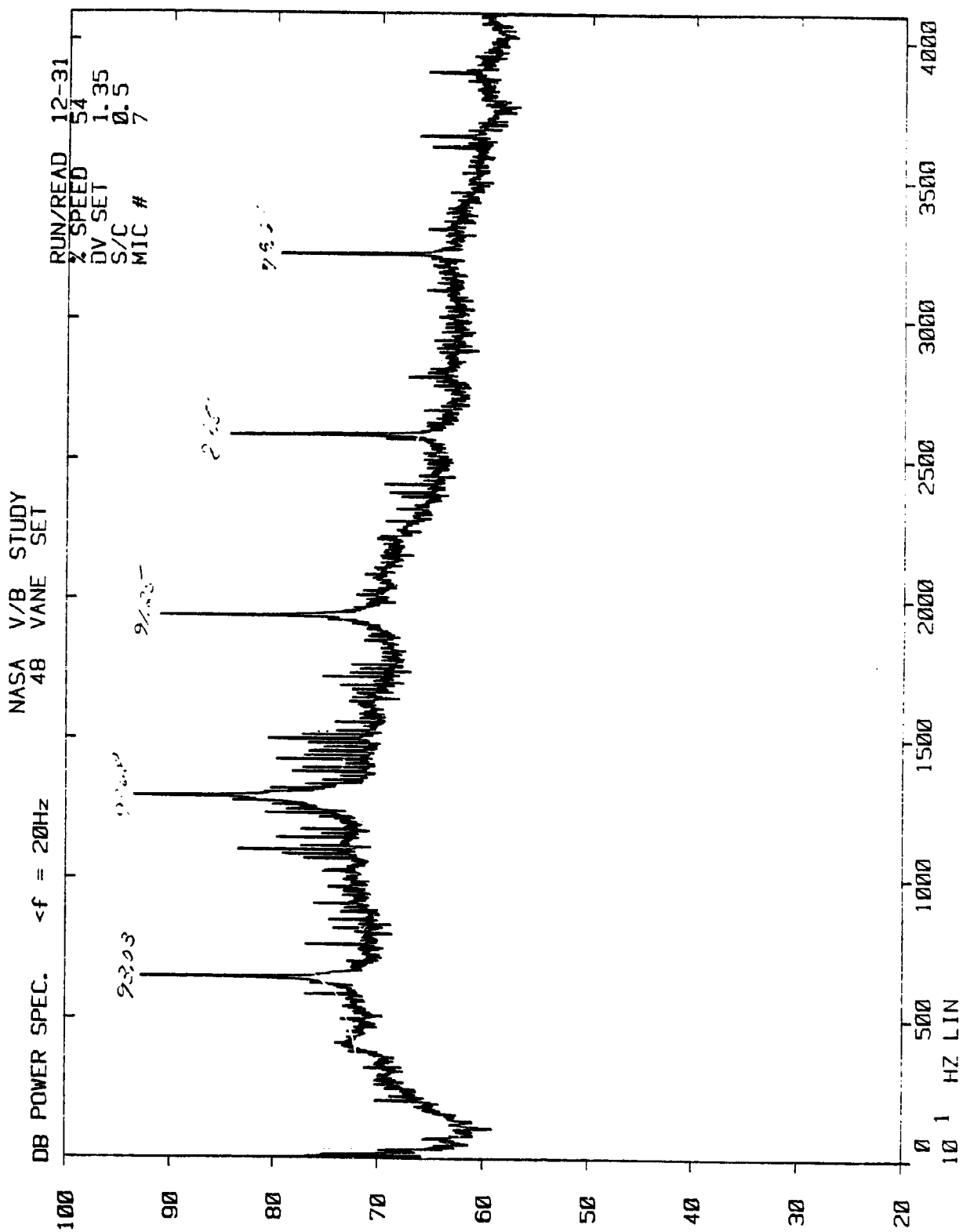
RUN/READ 1231
Z SPEED
DV SET
S/C 0.5
MIC # 6

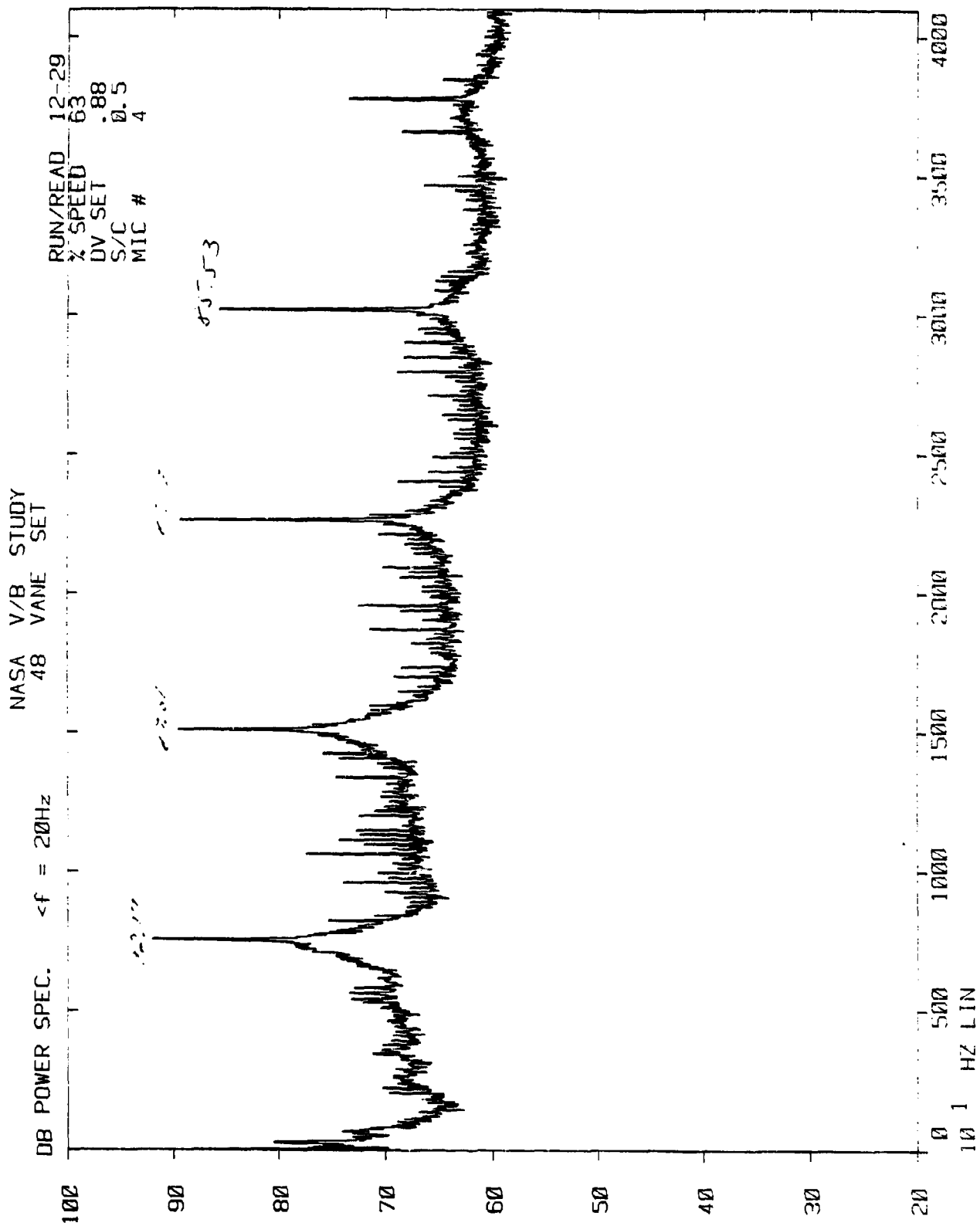


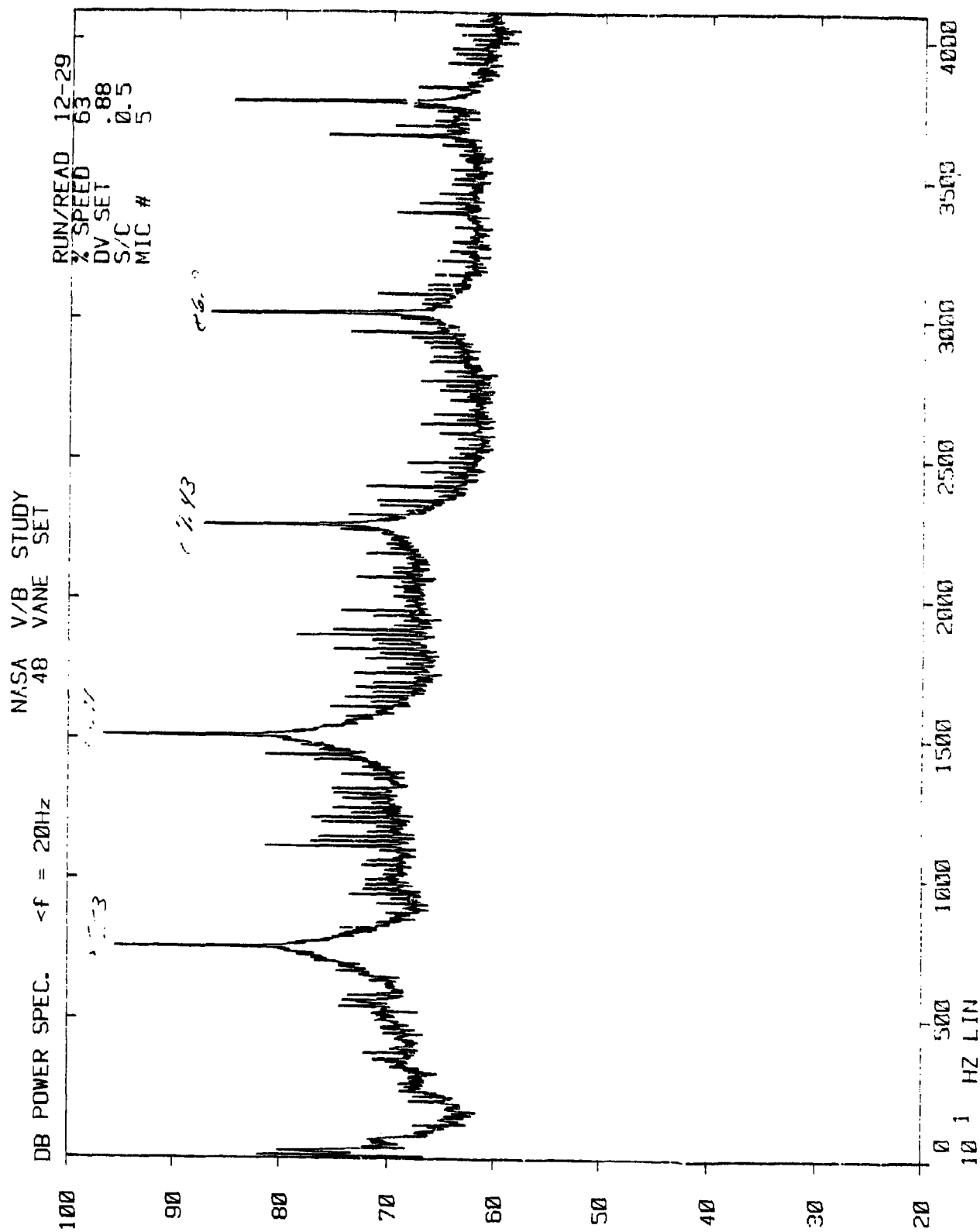


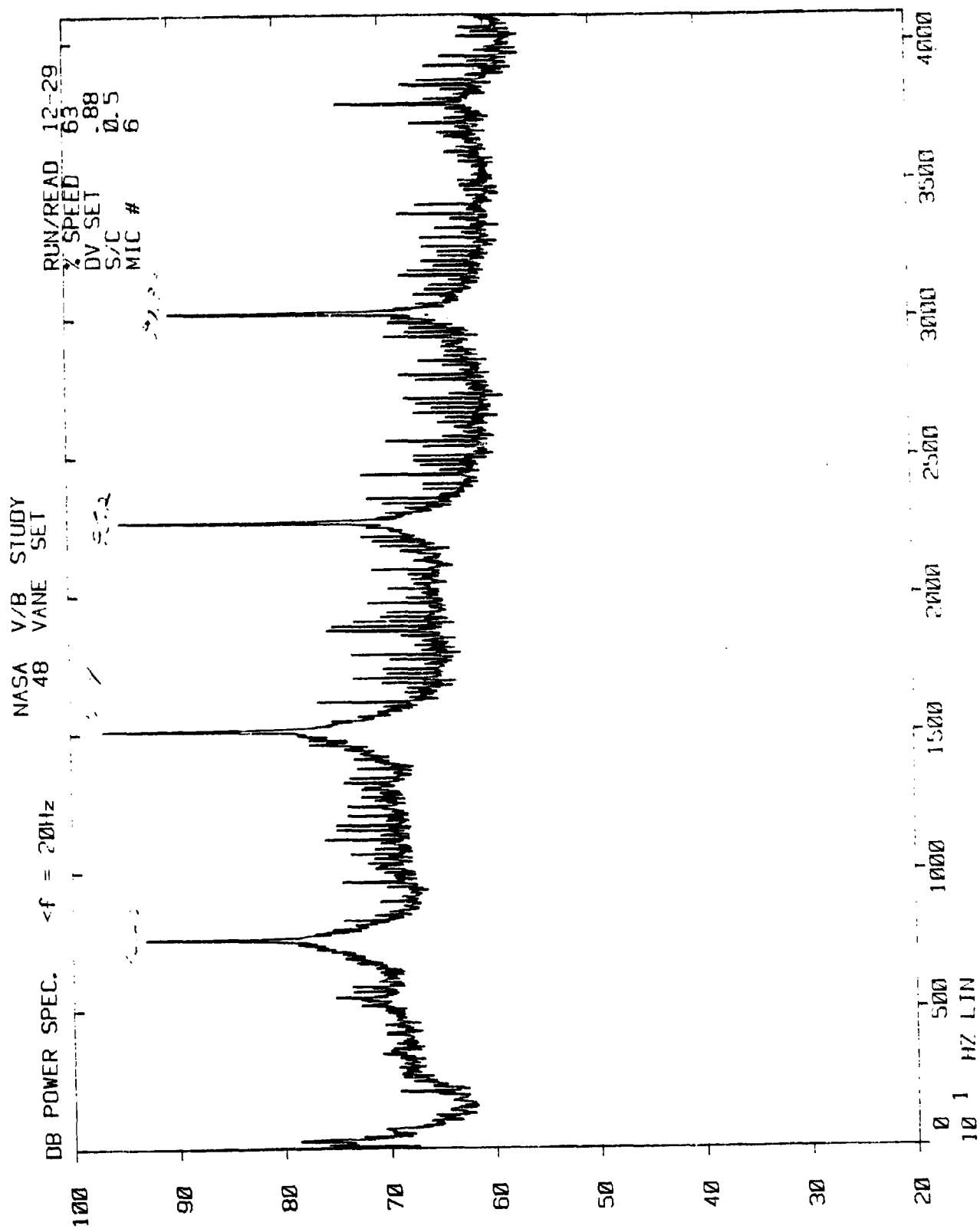








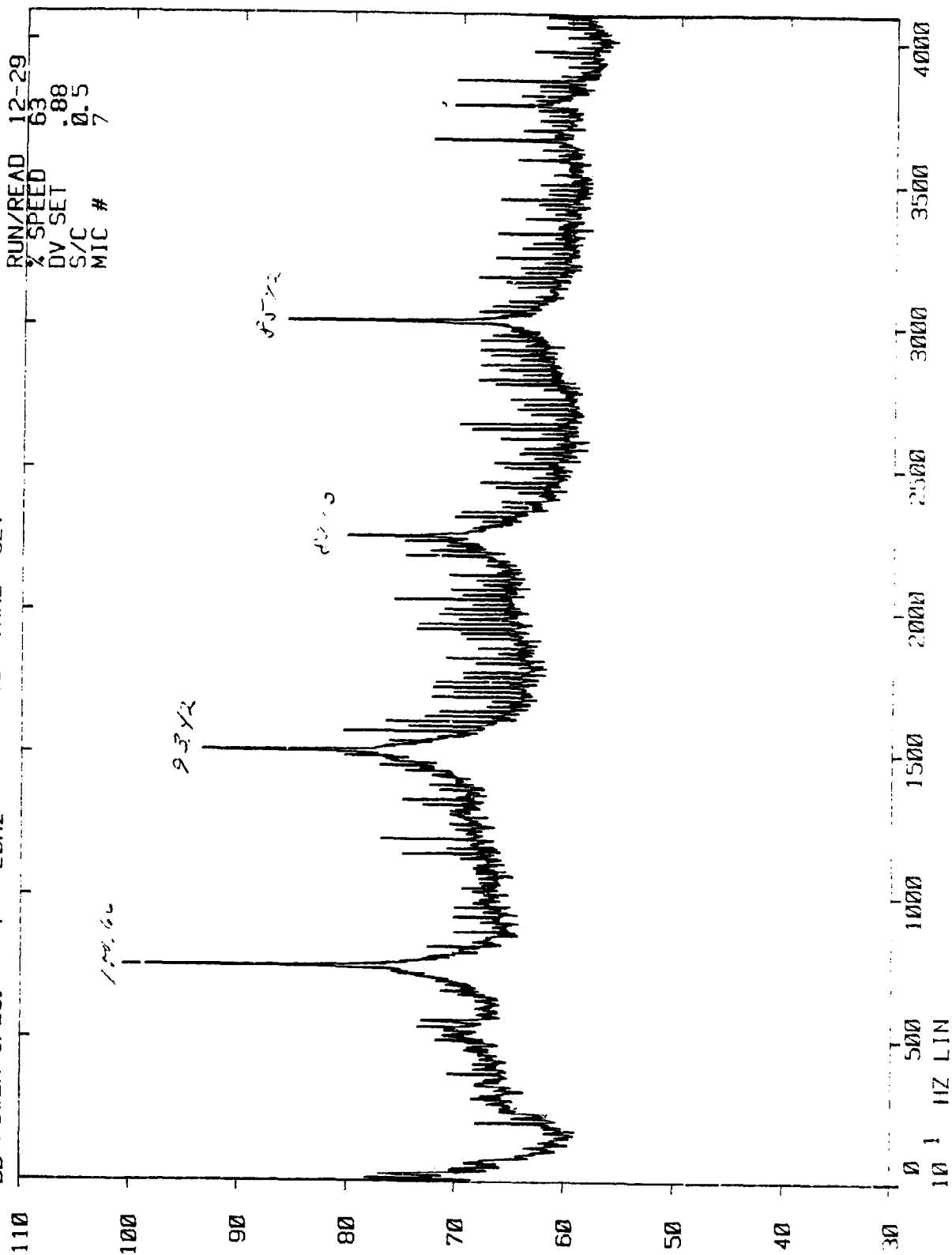


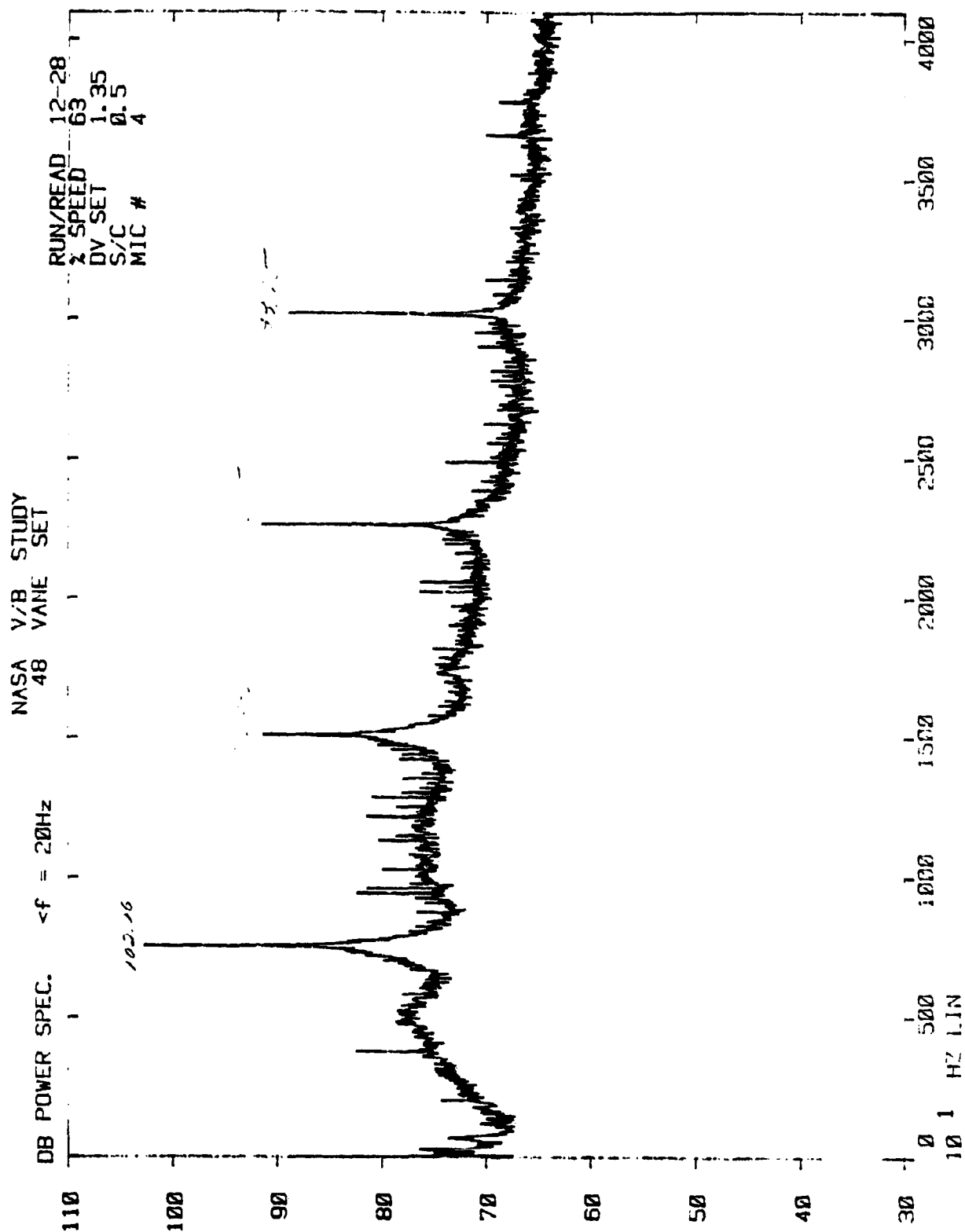


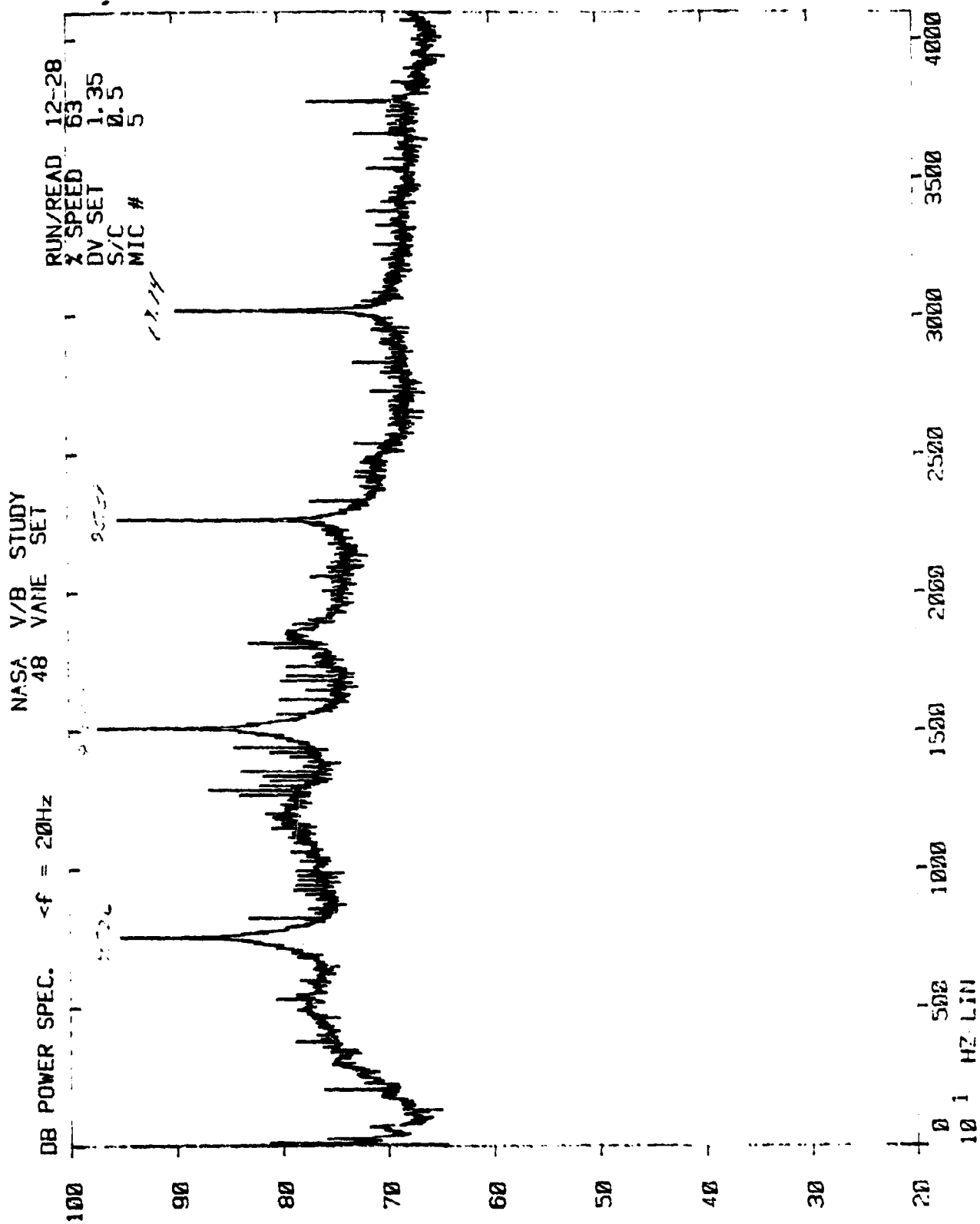
NASA V/B STUDY
48 VANE SET

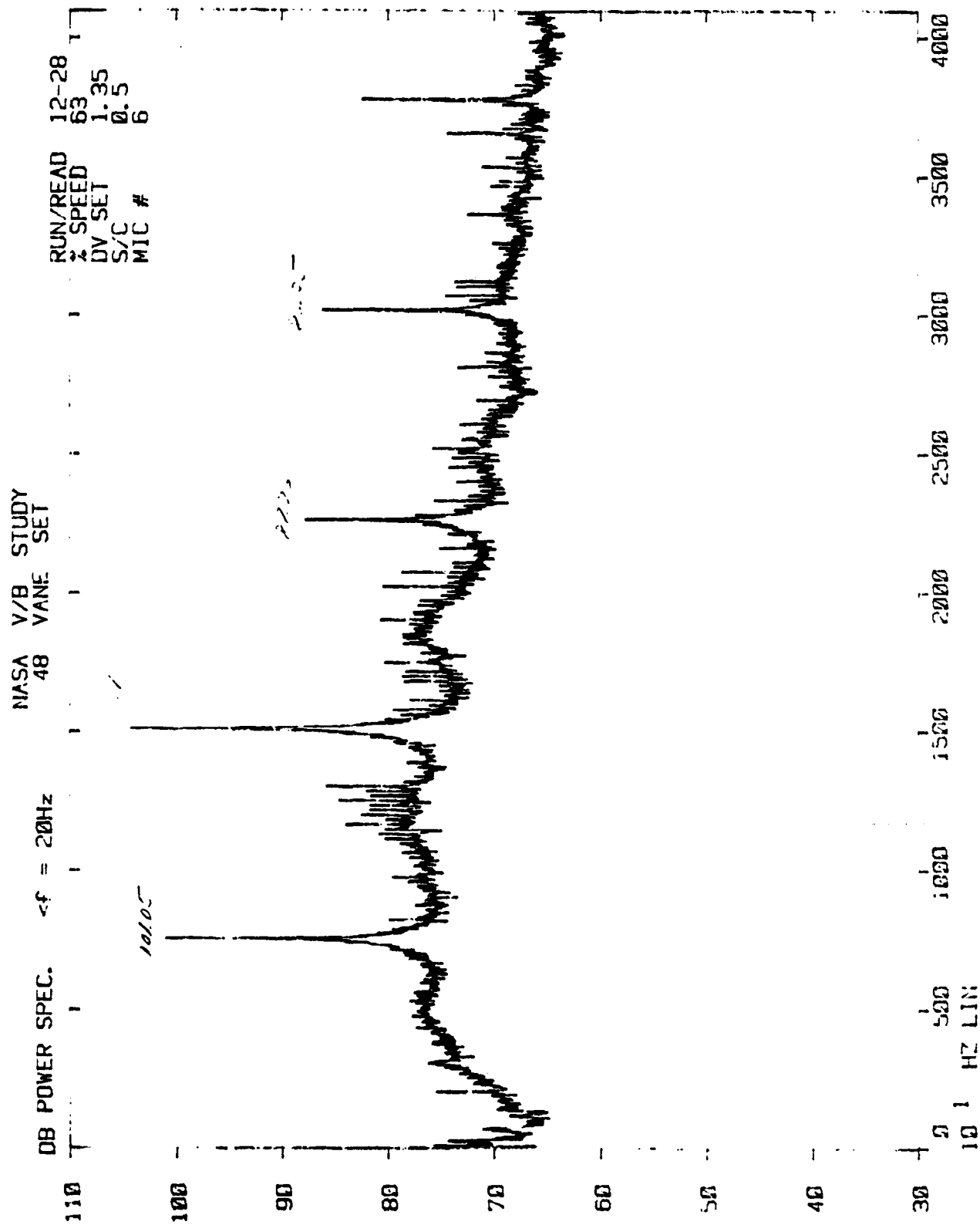
<f = 20Hz

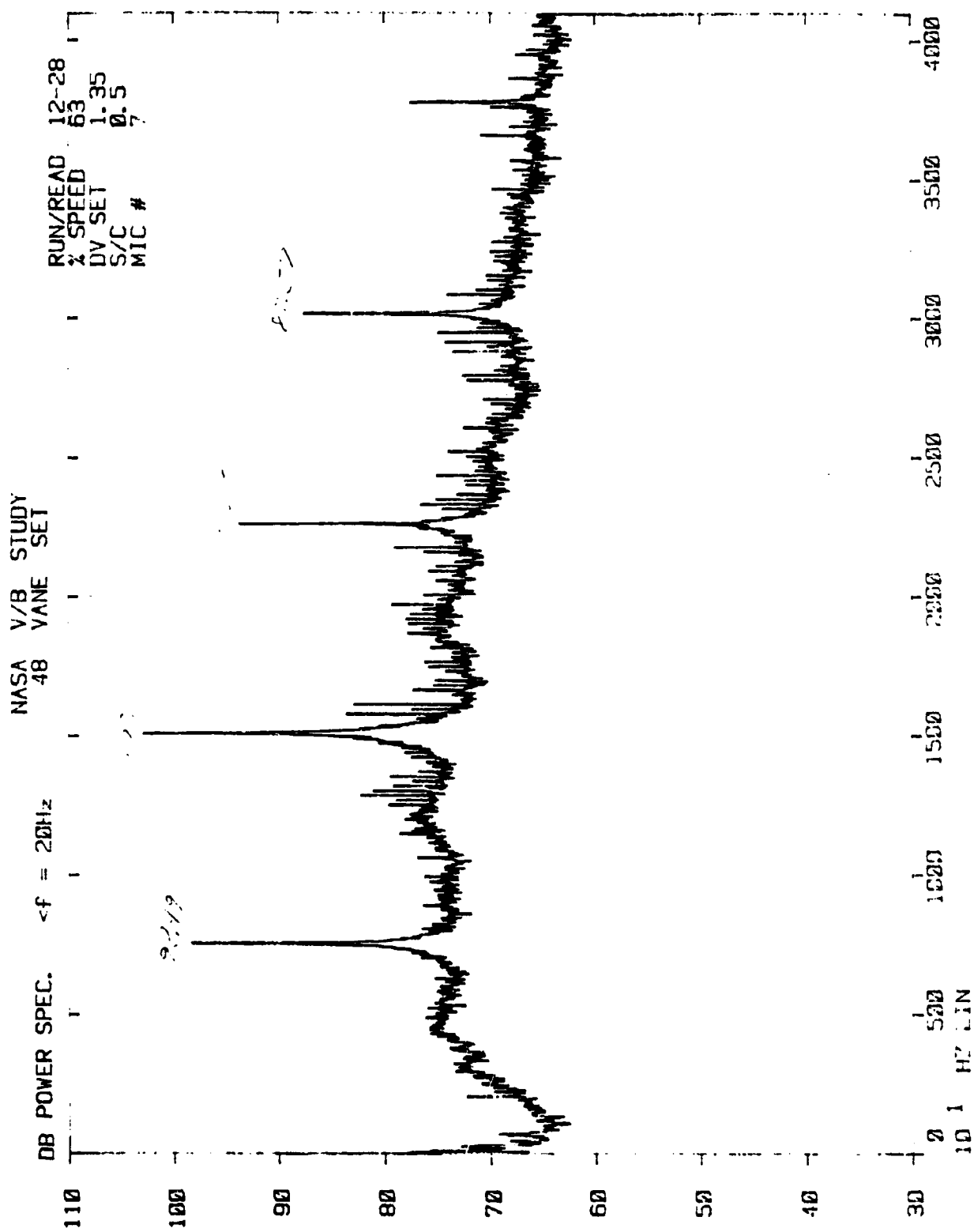
DB POWER SPEC.











NASA V/B STUDY
48 VANE SET

<f = 20Hz

DB POWER SPEC.

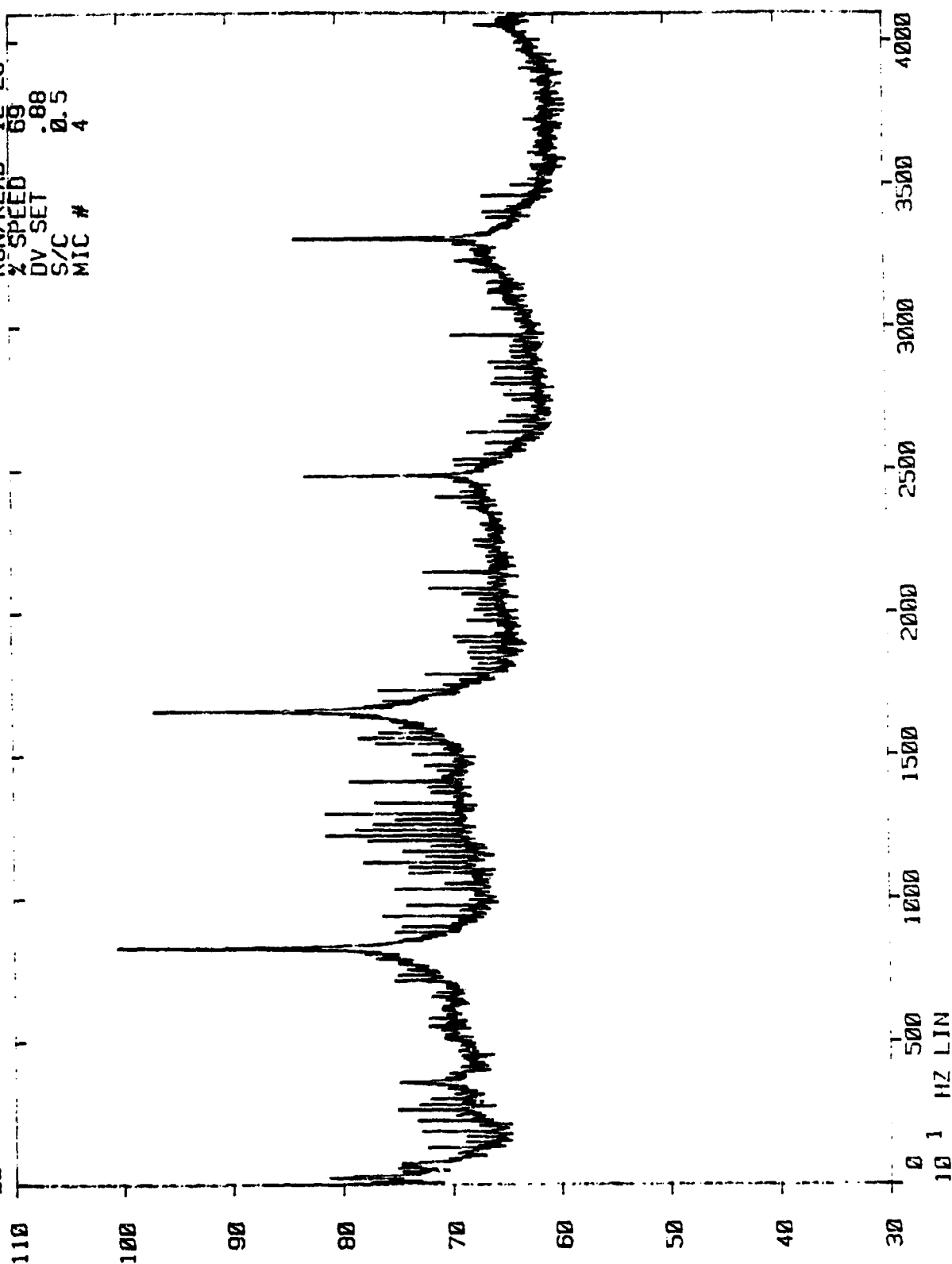
RUN/READ 12-26

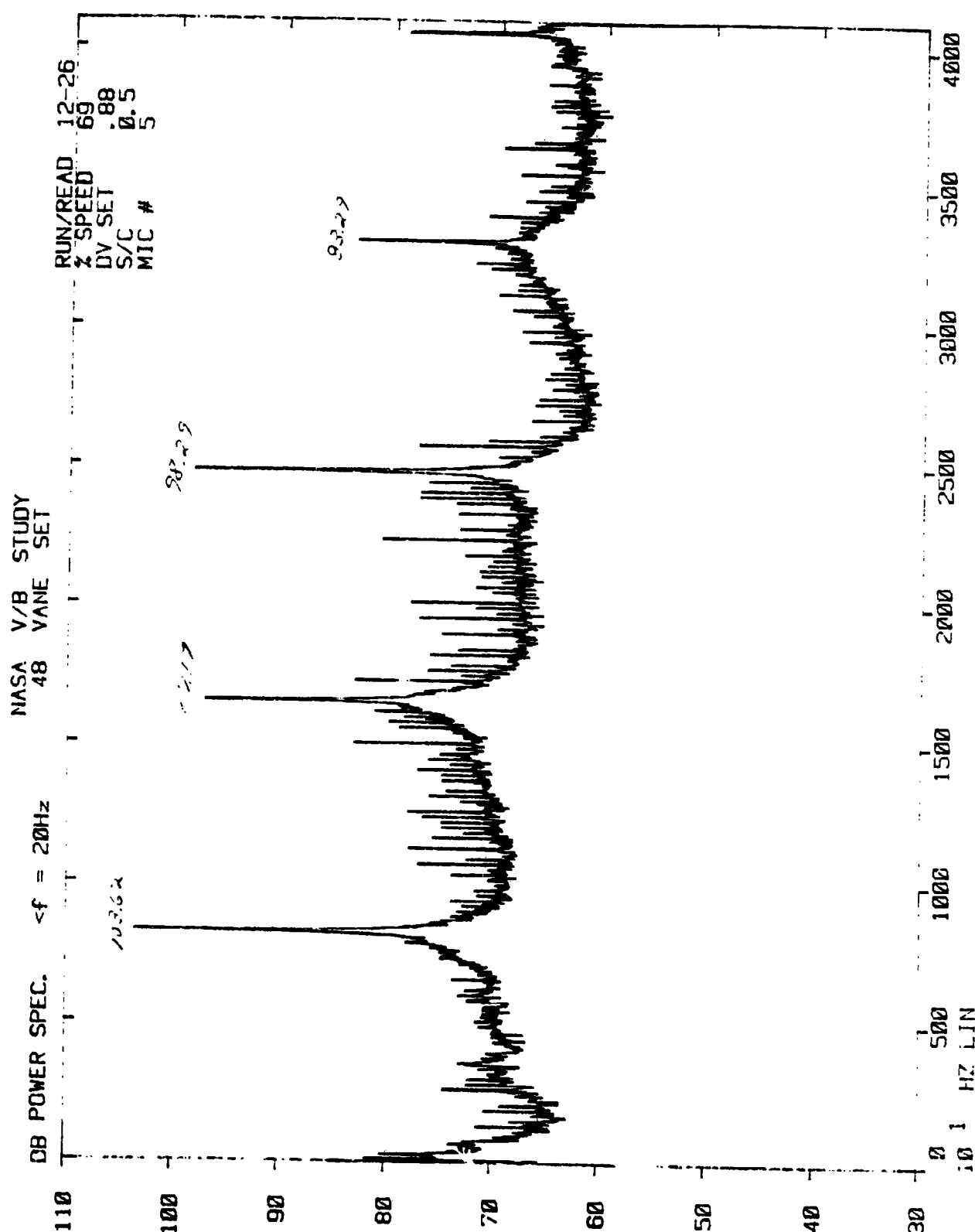
% SPEED 69

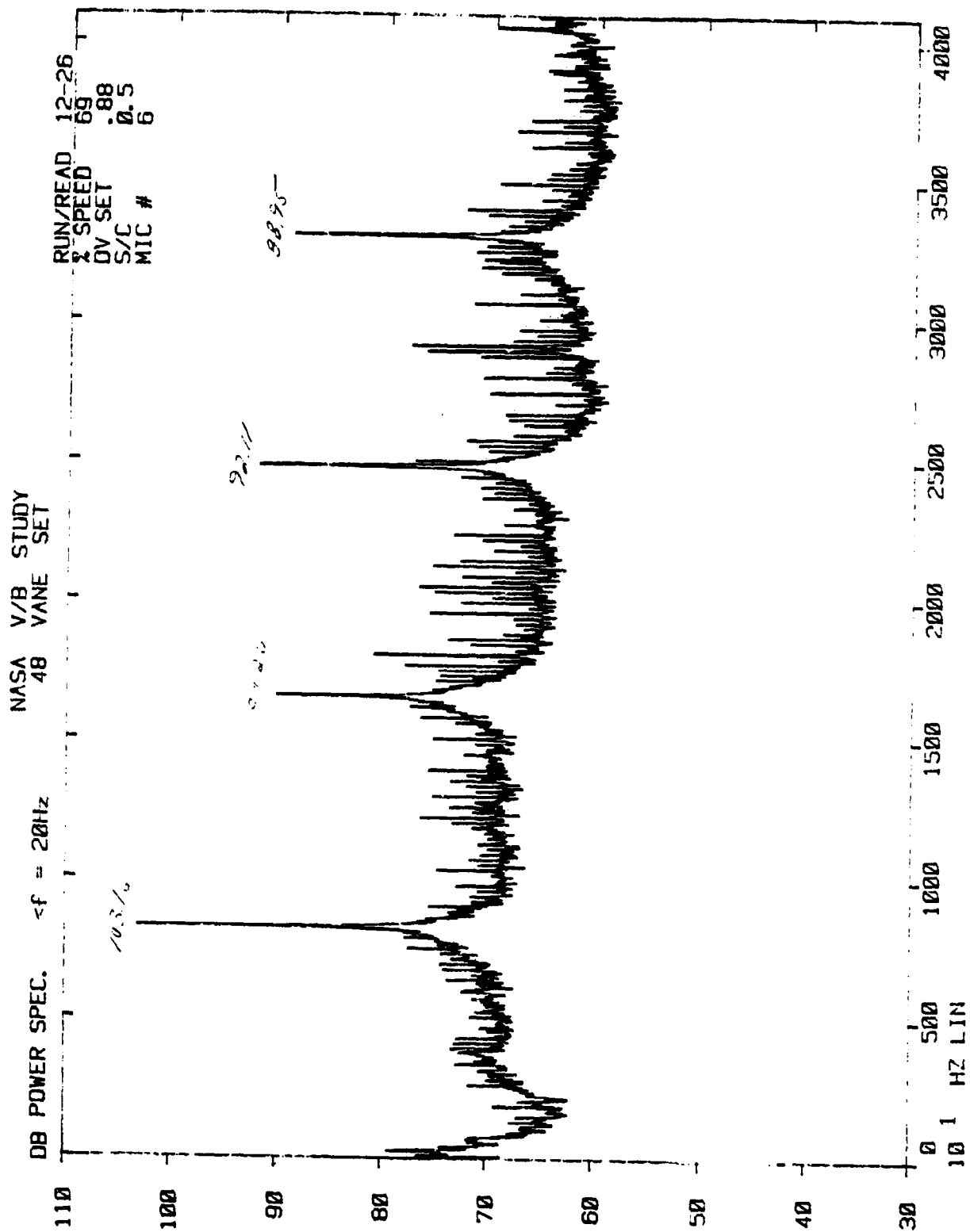
DV SET .88

S/C 0.5

MIC # 4





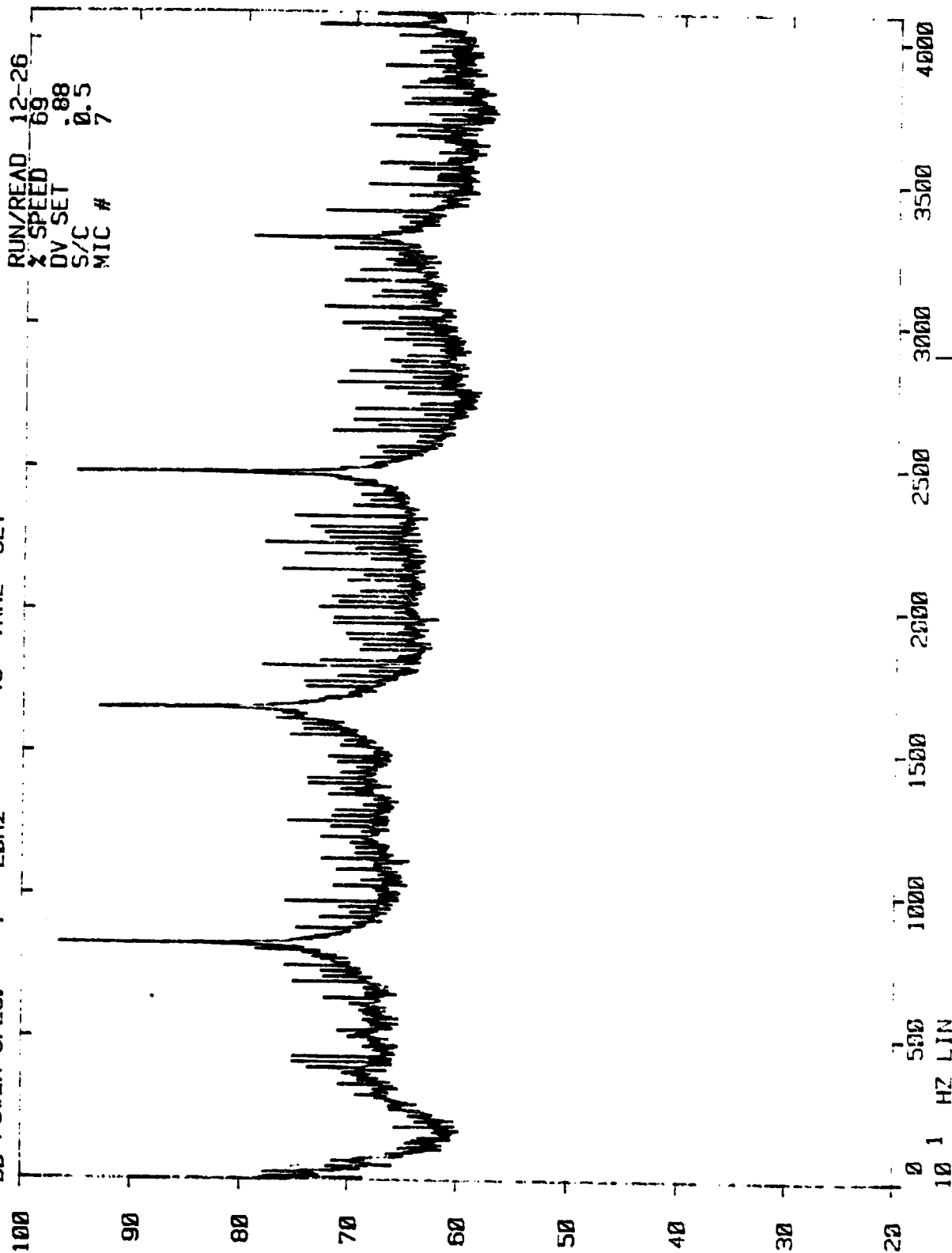


NASA V/B STUDY
48 VANE SET

<f = 20Hz

DB POWER SPEC.

RUN/READ 12-26
X SPEED 69
DV SET .88
S/C 0.5
MIC # 7



NASA V/B STUDY
48 VANE SET

$\Delta f = 20\text{Hz}$

DB POWER SPEC.

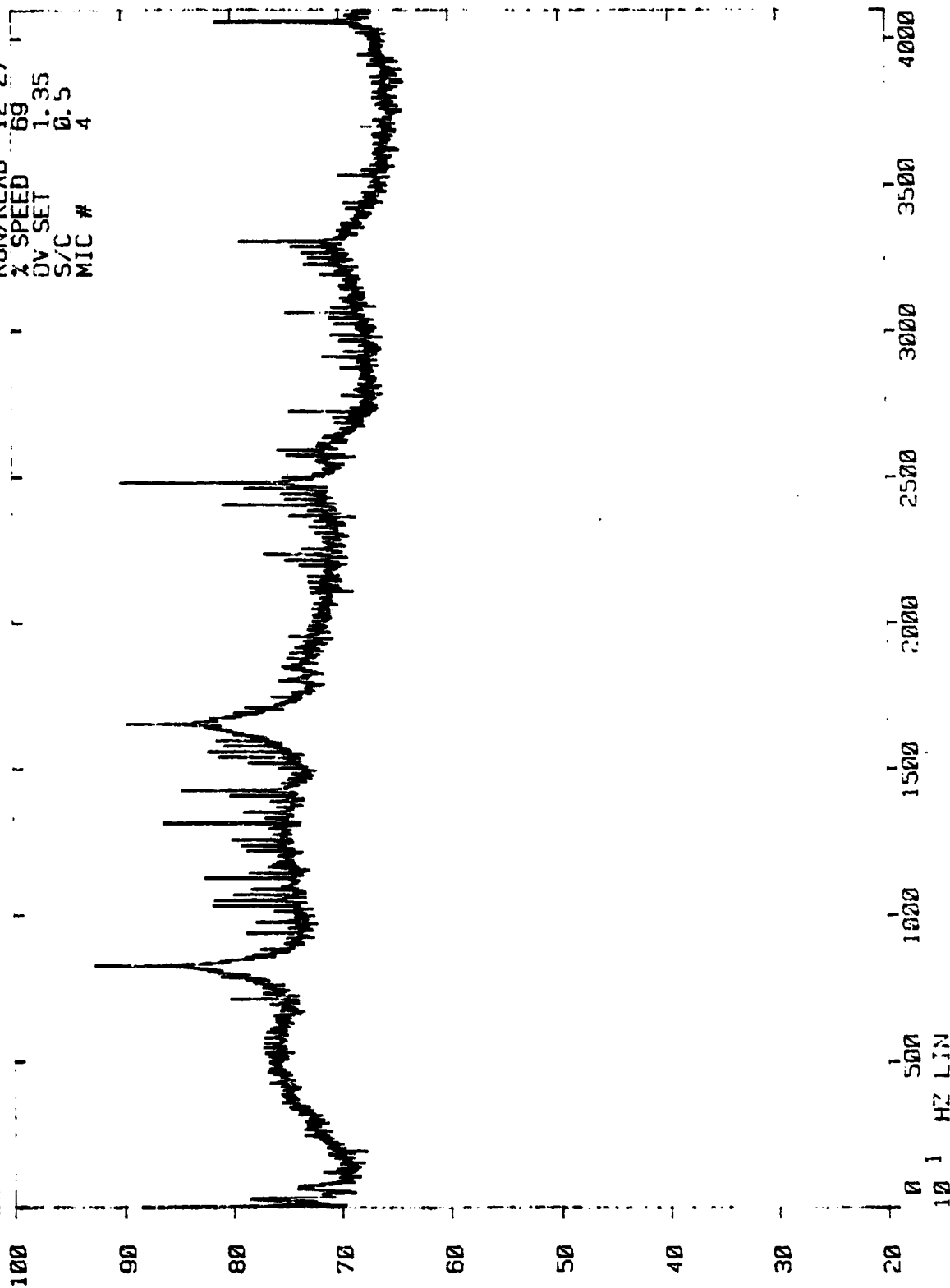
RUN/READ 12-27

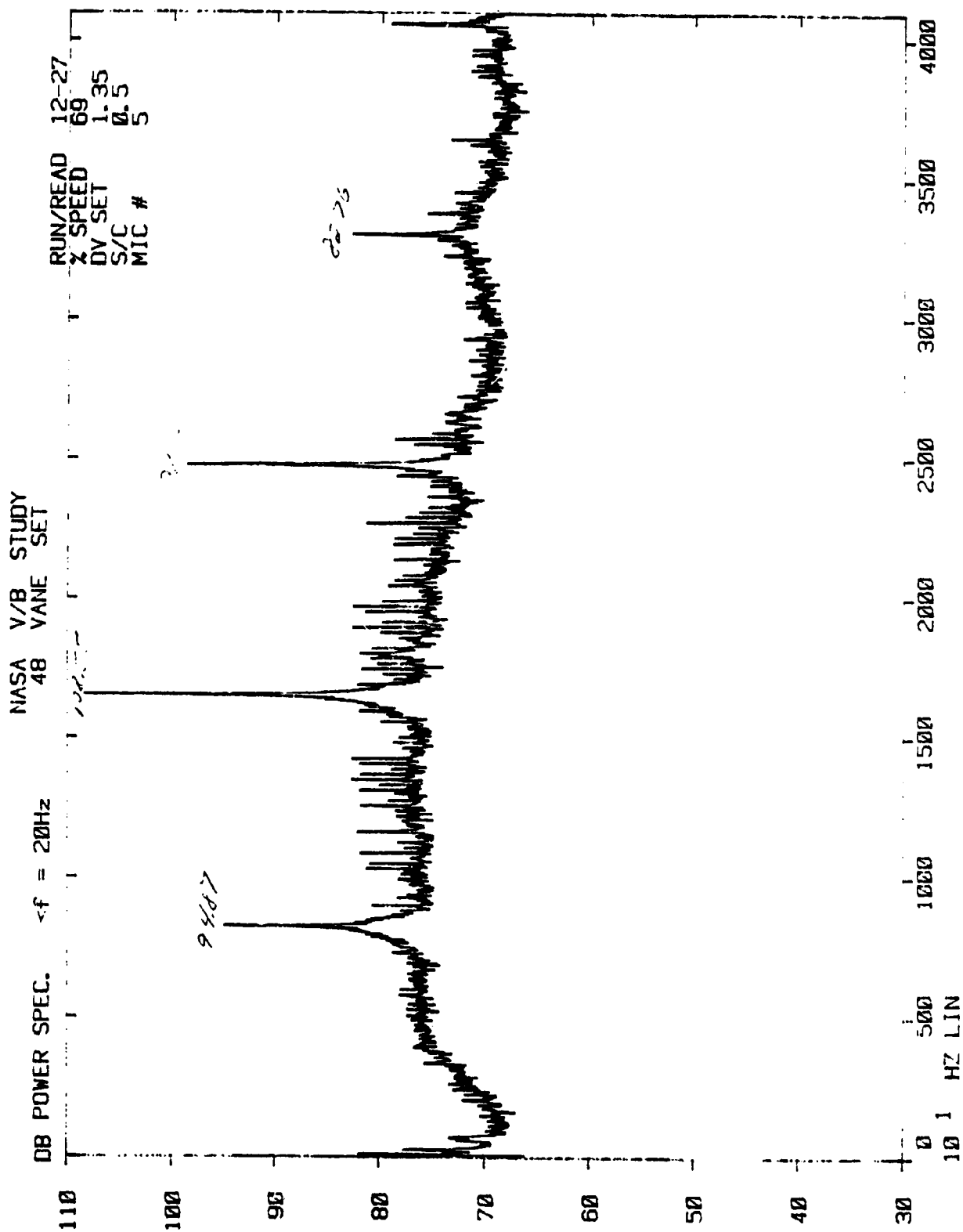
% SPEED 69

OV SET 1.35

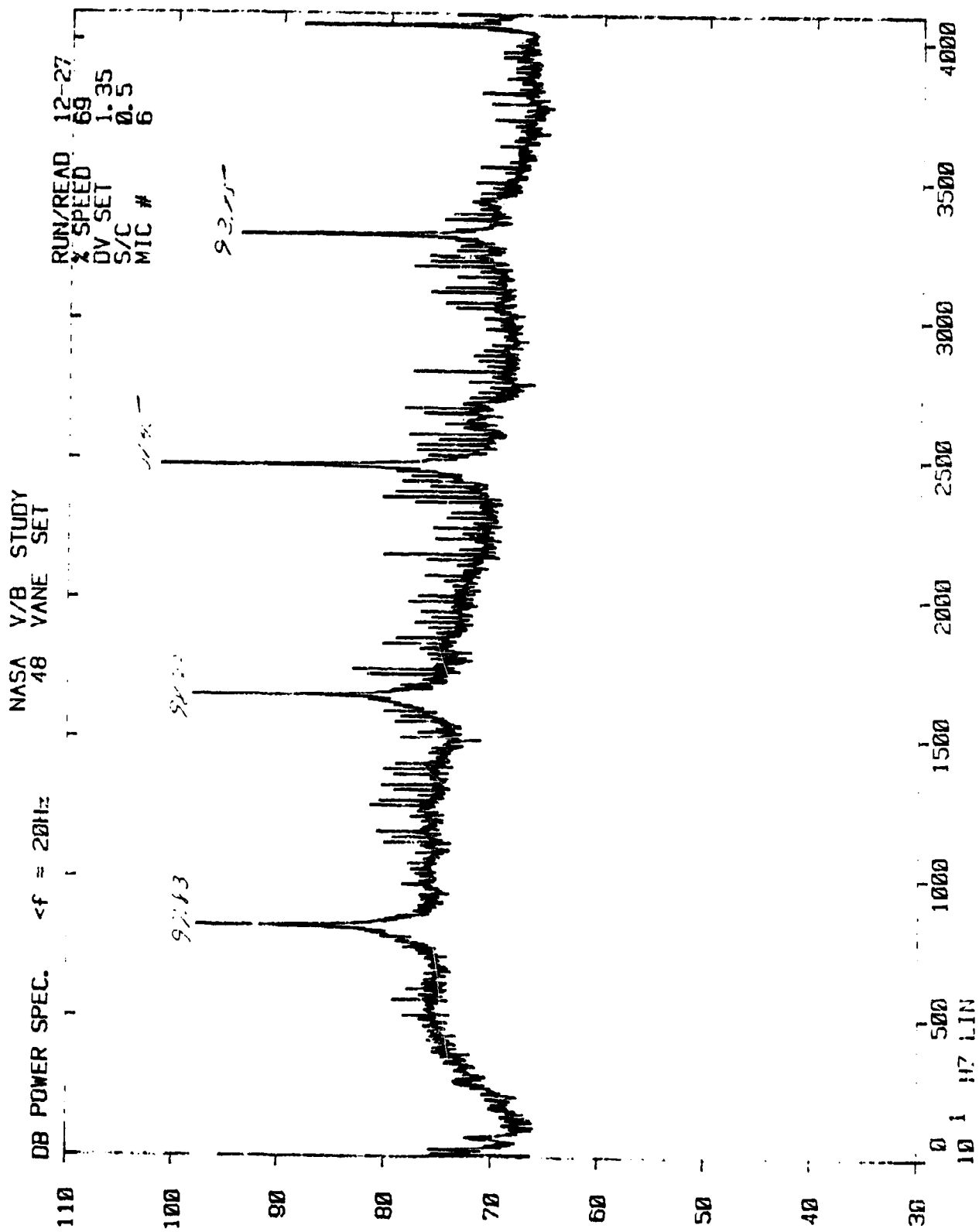
S/C 0.5

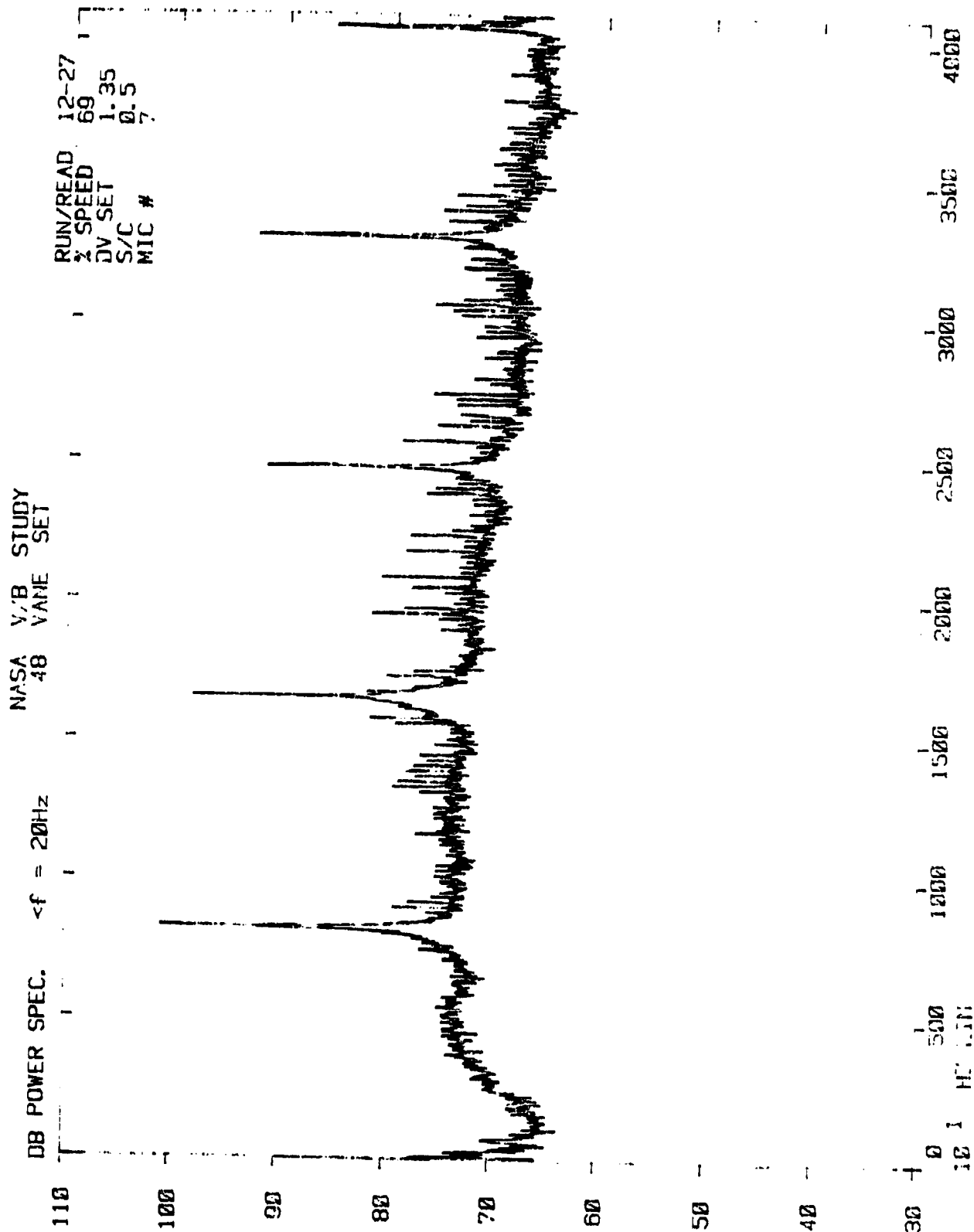
MIC # 4

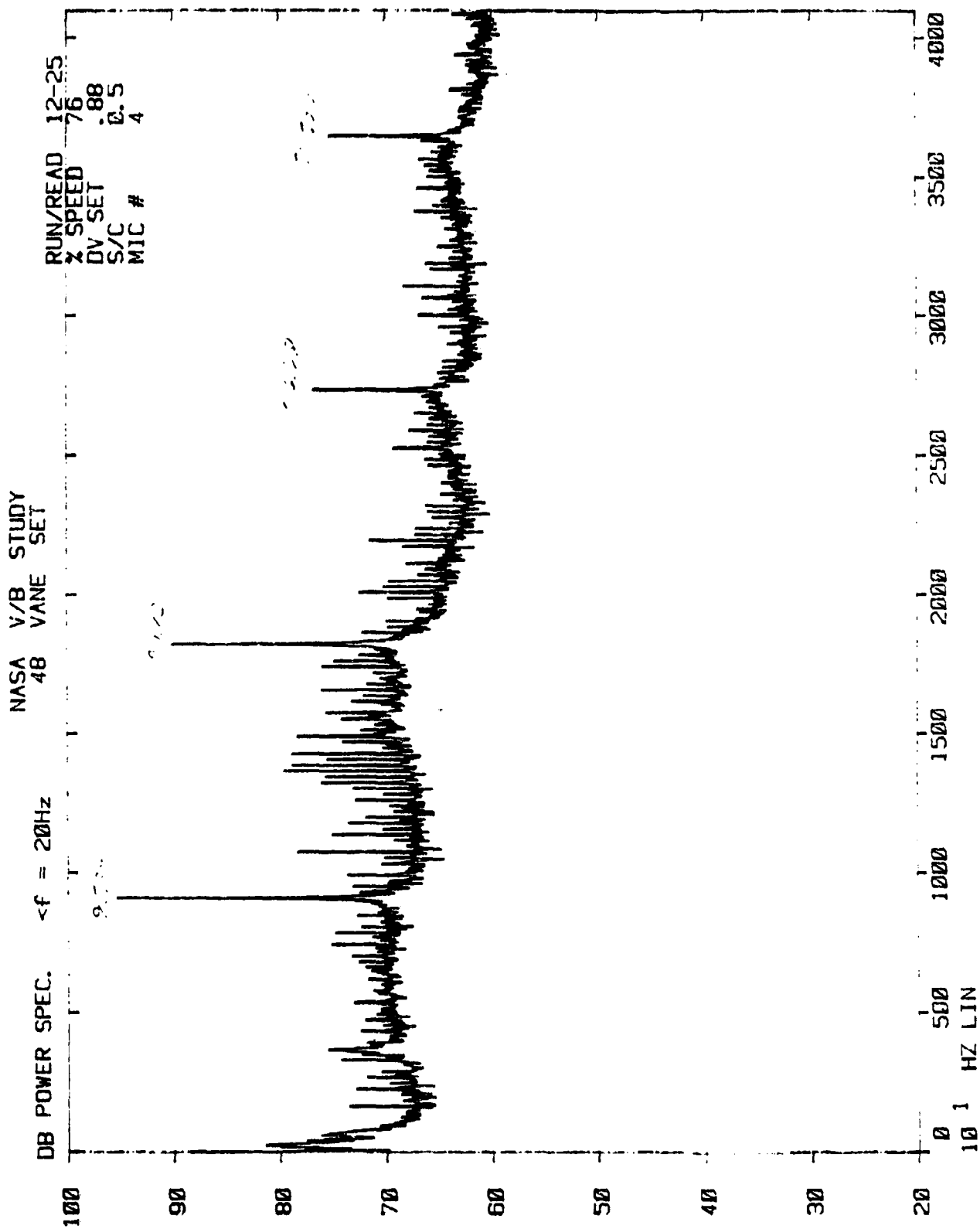


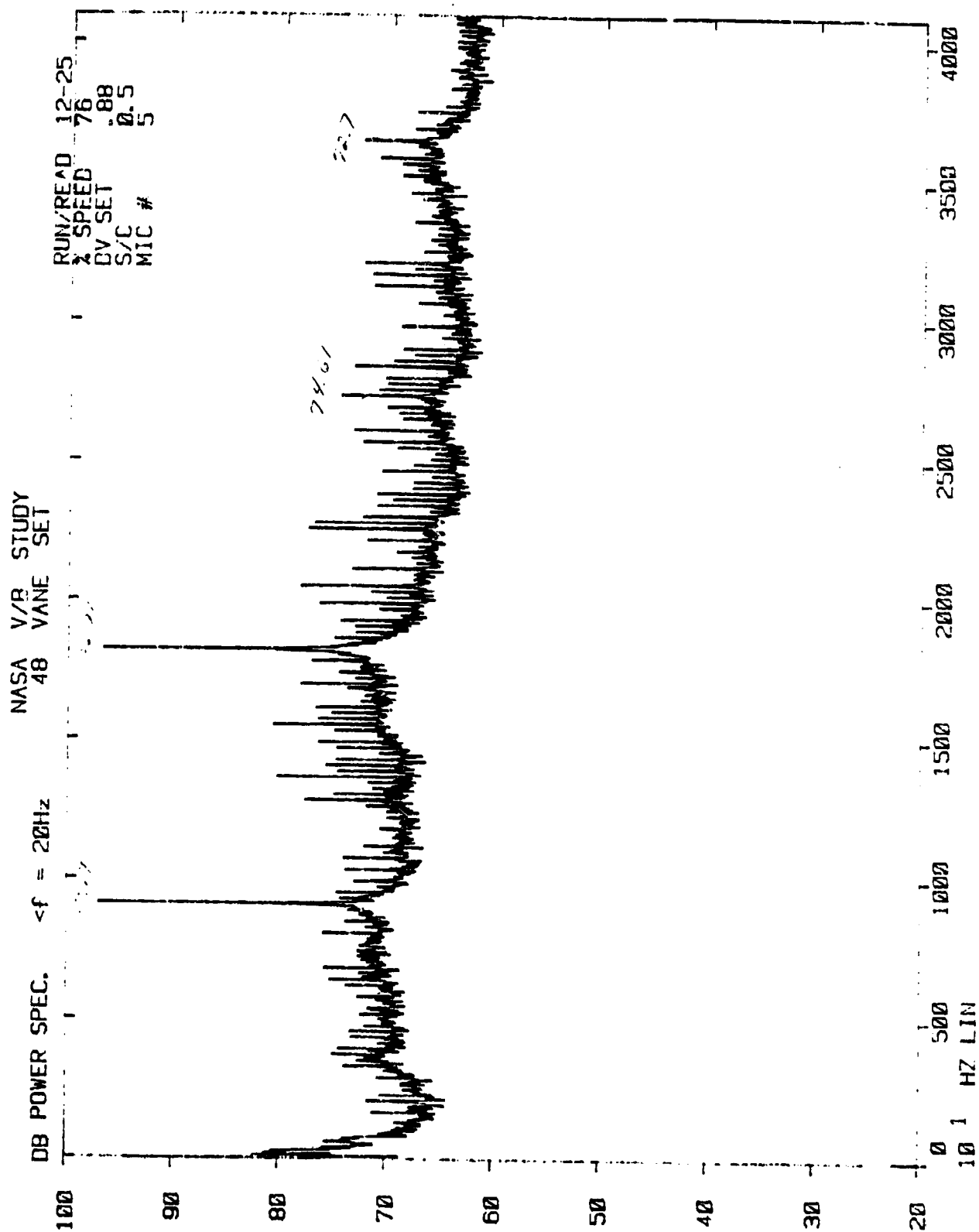


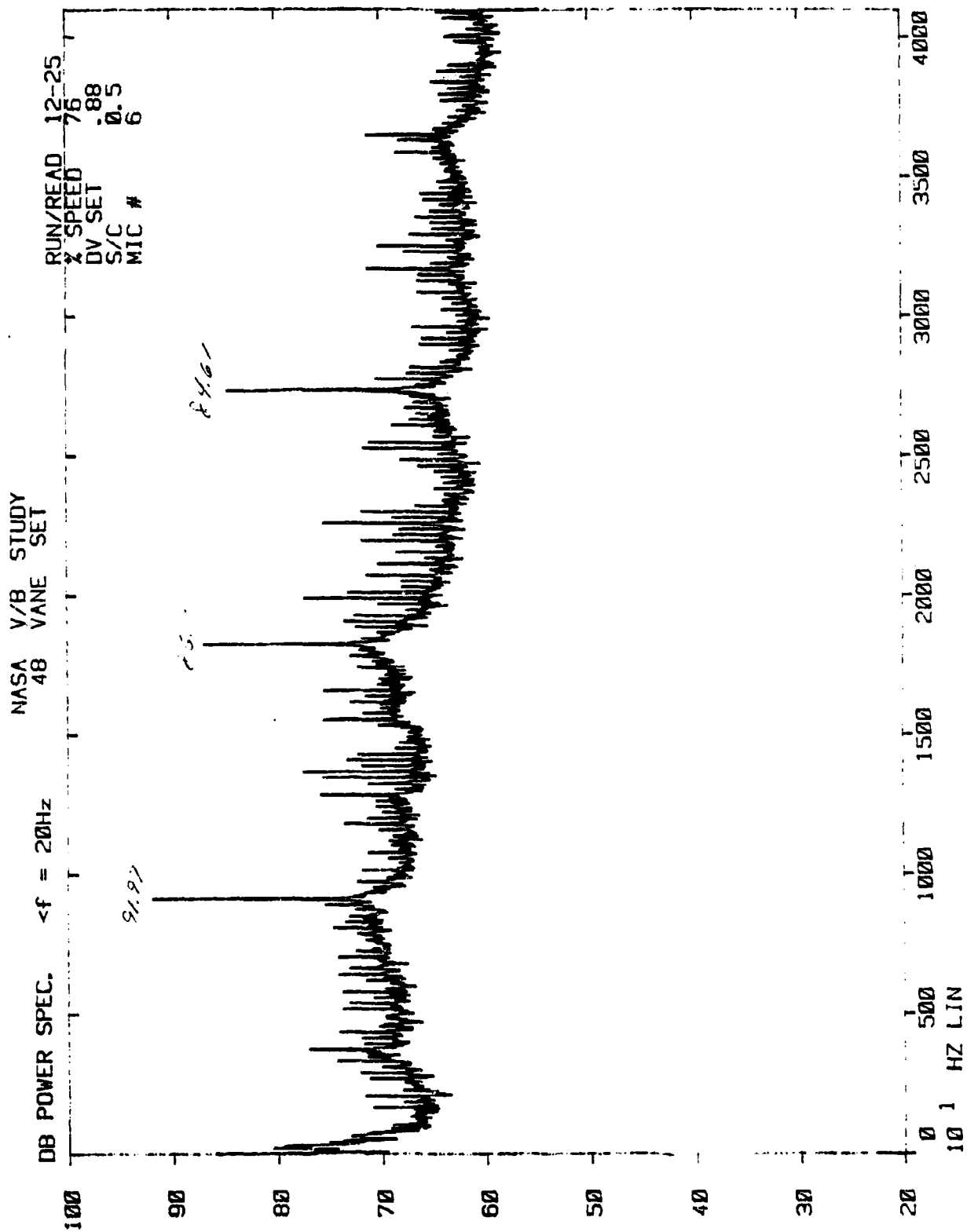
✓









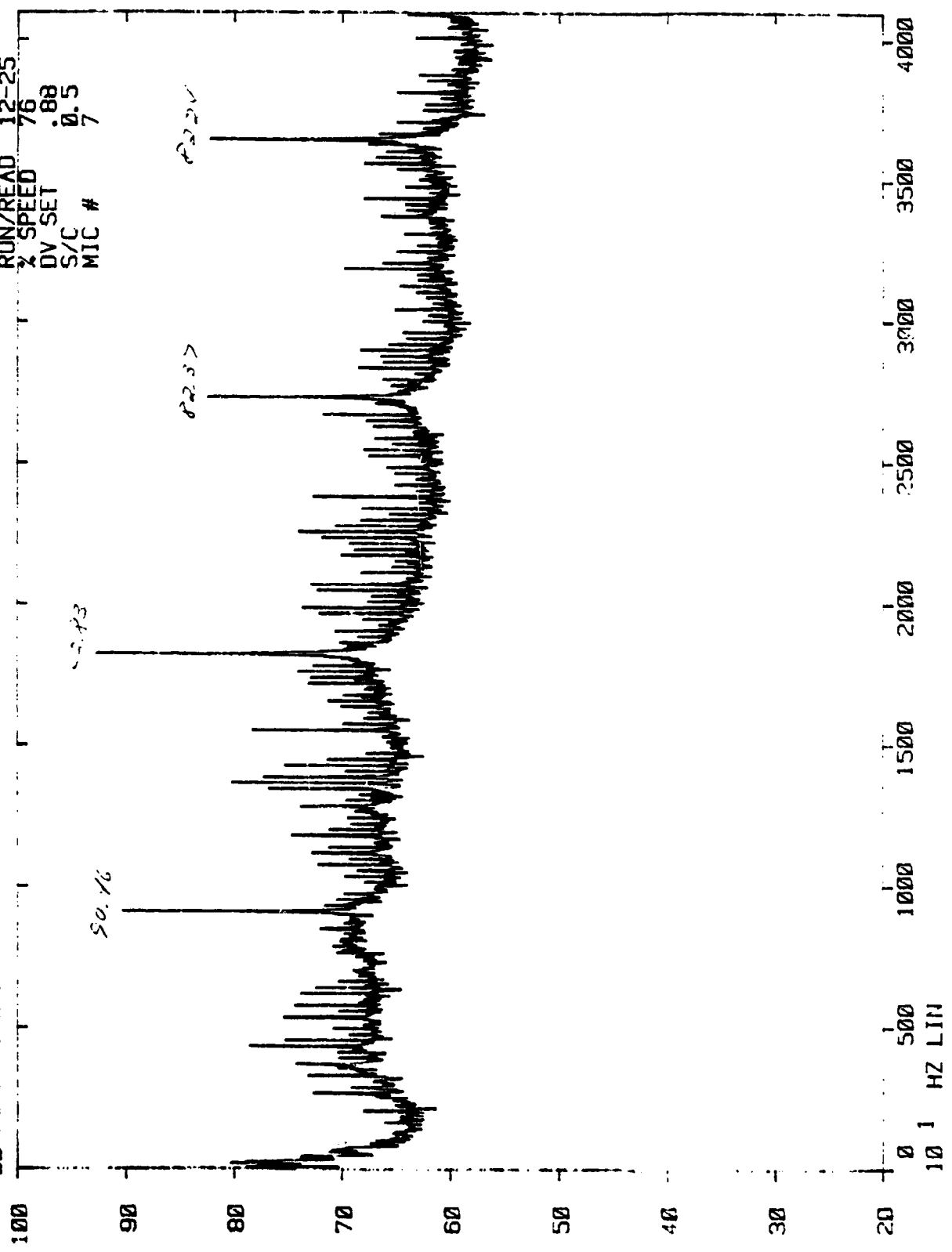


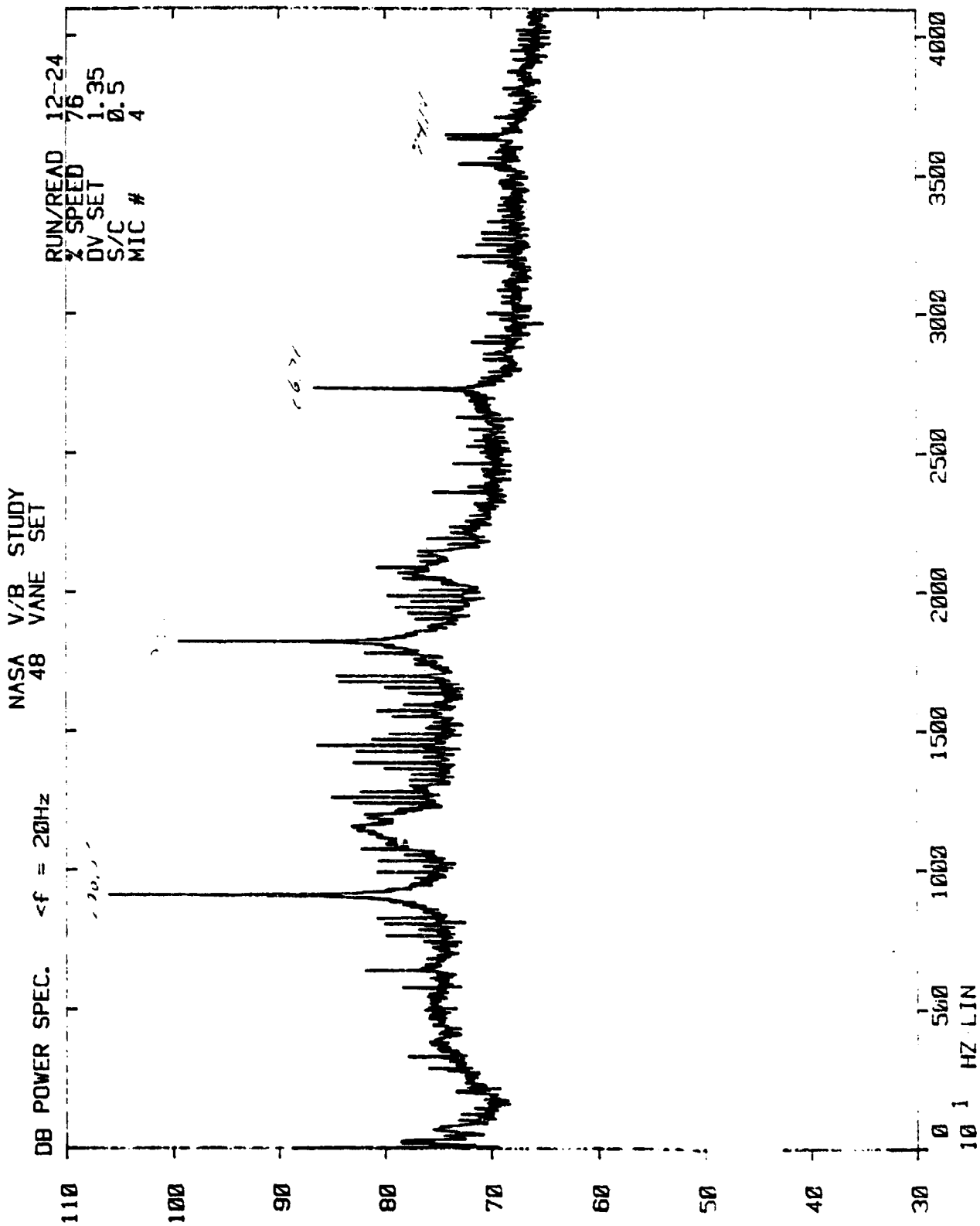
NASA V/B STUDY
48 VANE SET

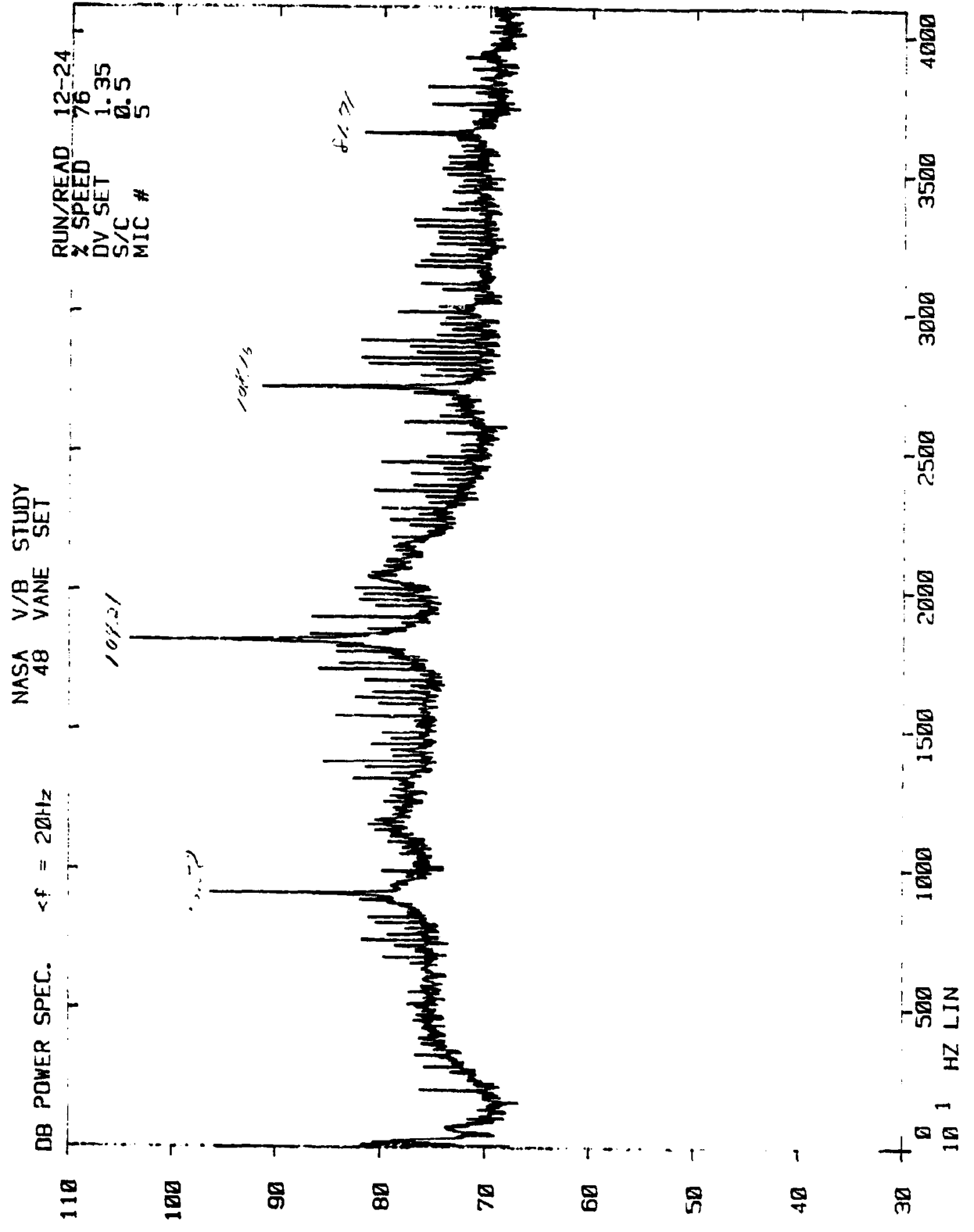
<f = 20Hz

DB POWER SPEC.

RUN/READ 12-25
% SPEED 76
DV SET .88
S/C 0.5
MIC # 7





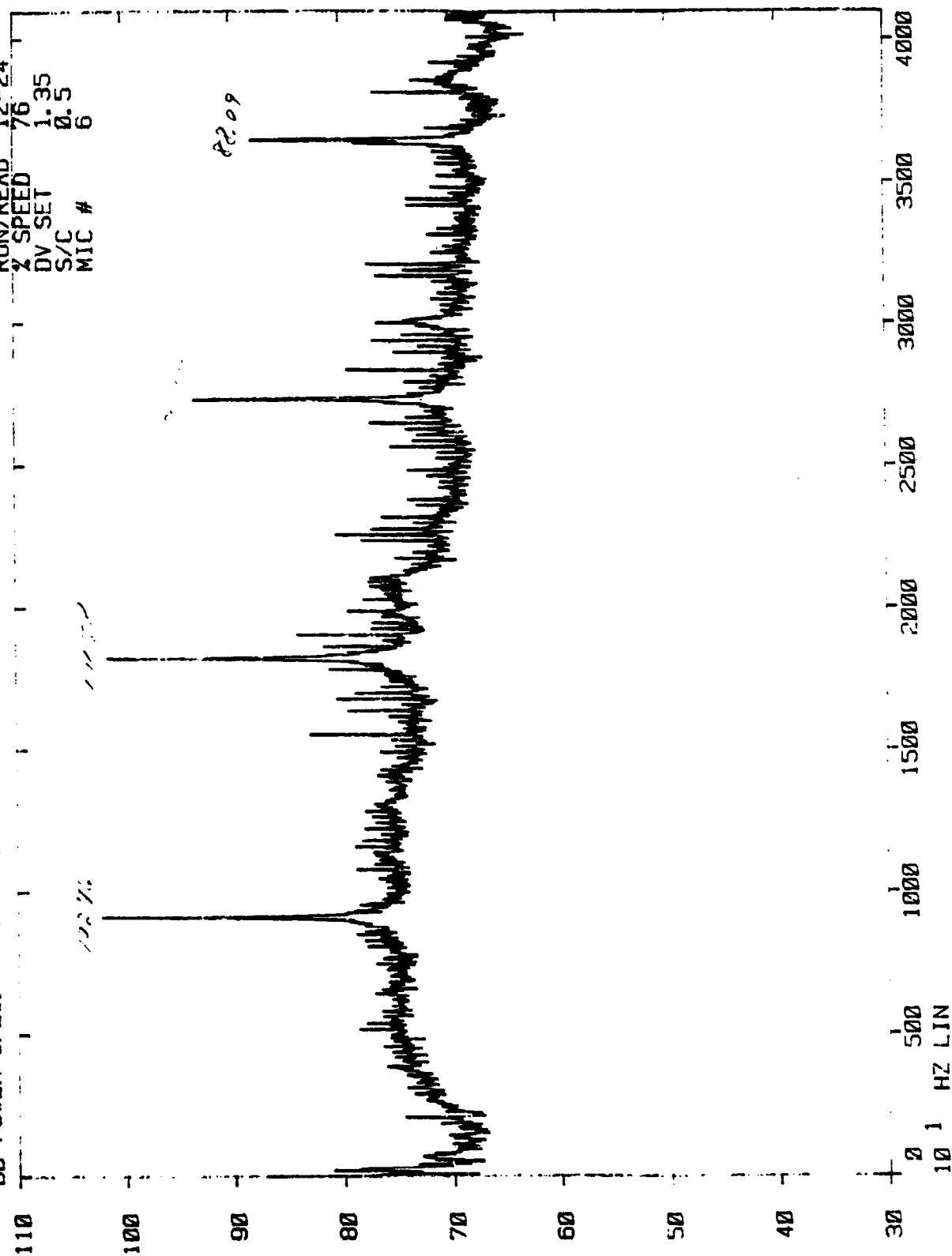


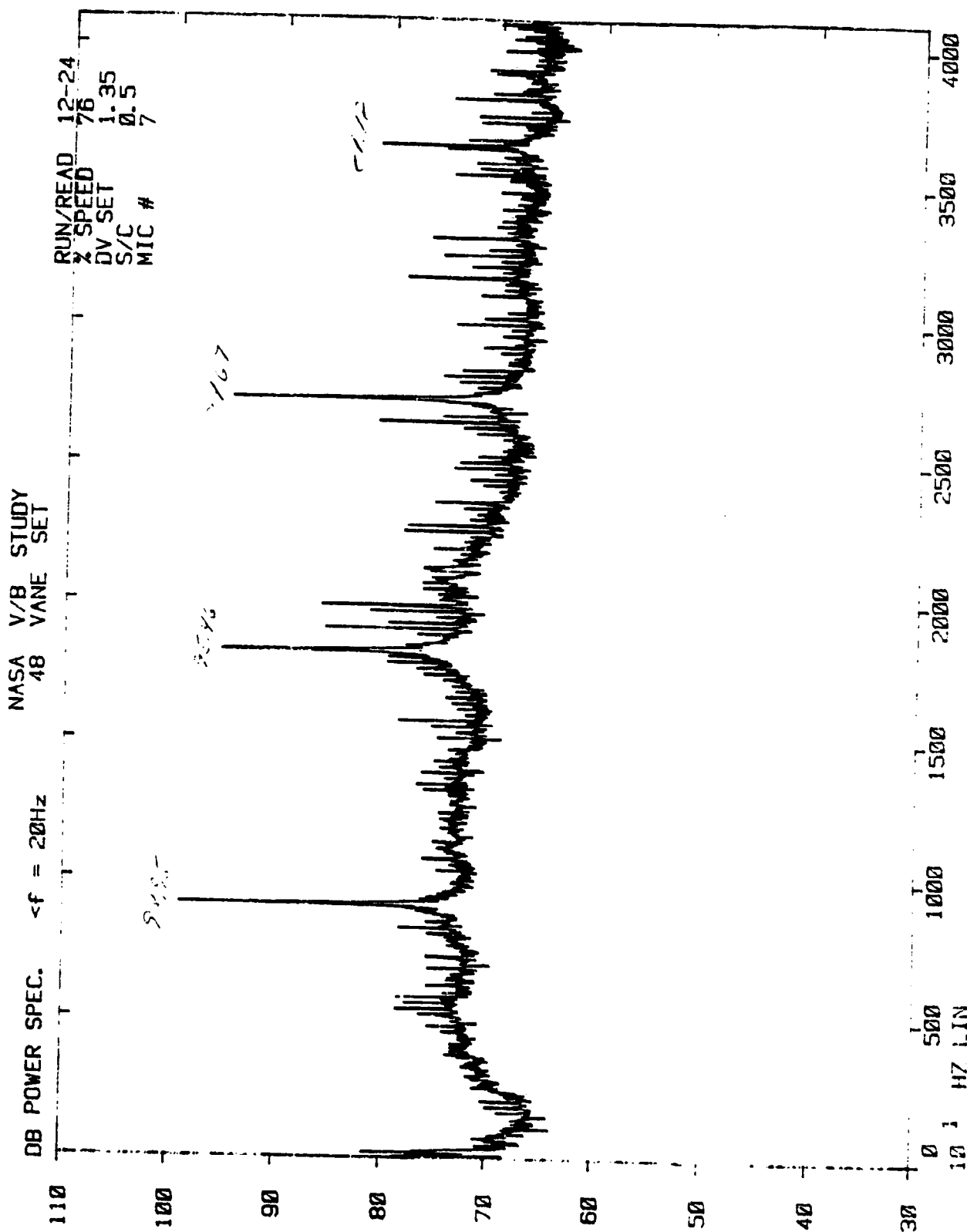
NASA V/B STUDY
48 VANE SET

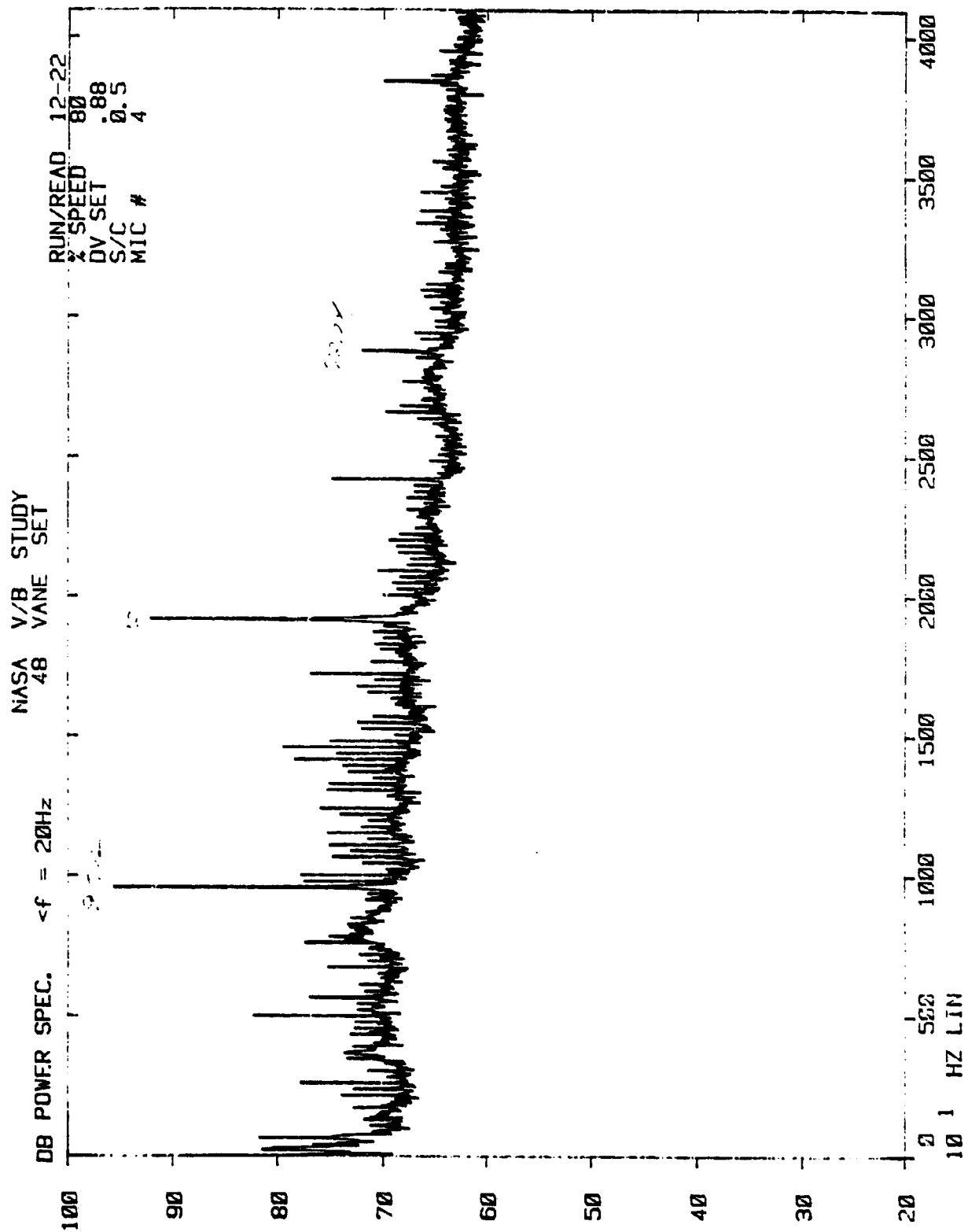
<f = 20Hz

DB POWER SPEC.

RUN/READ 12-24
% SPEED 76
DV SET 1.35
S/C 0.5
MIC # 6





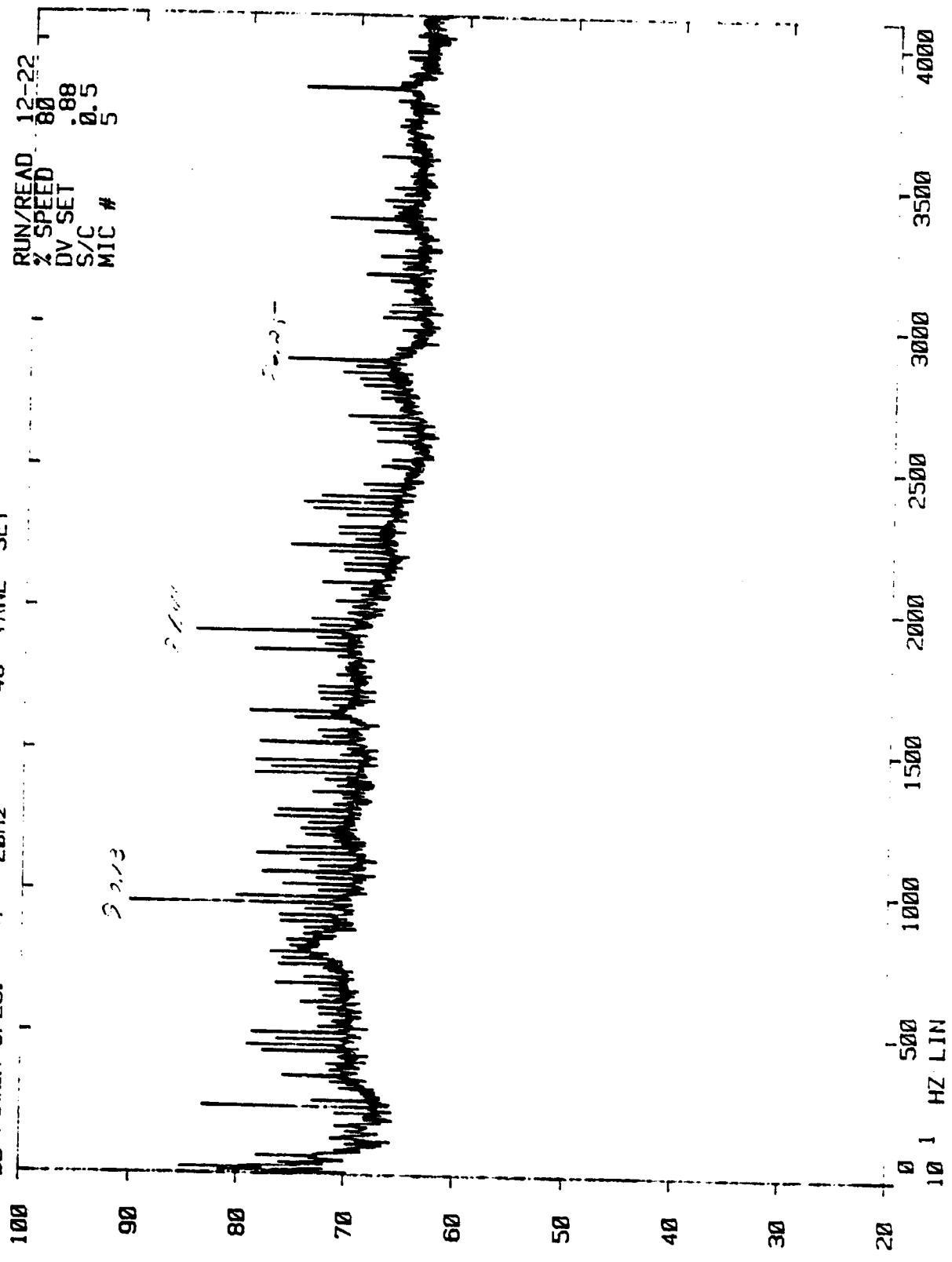


✓

NASA V/B STUDY
48 VANE SET

<f = 20Hz

DB POWER SPEC.

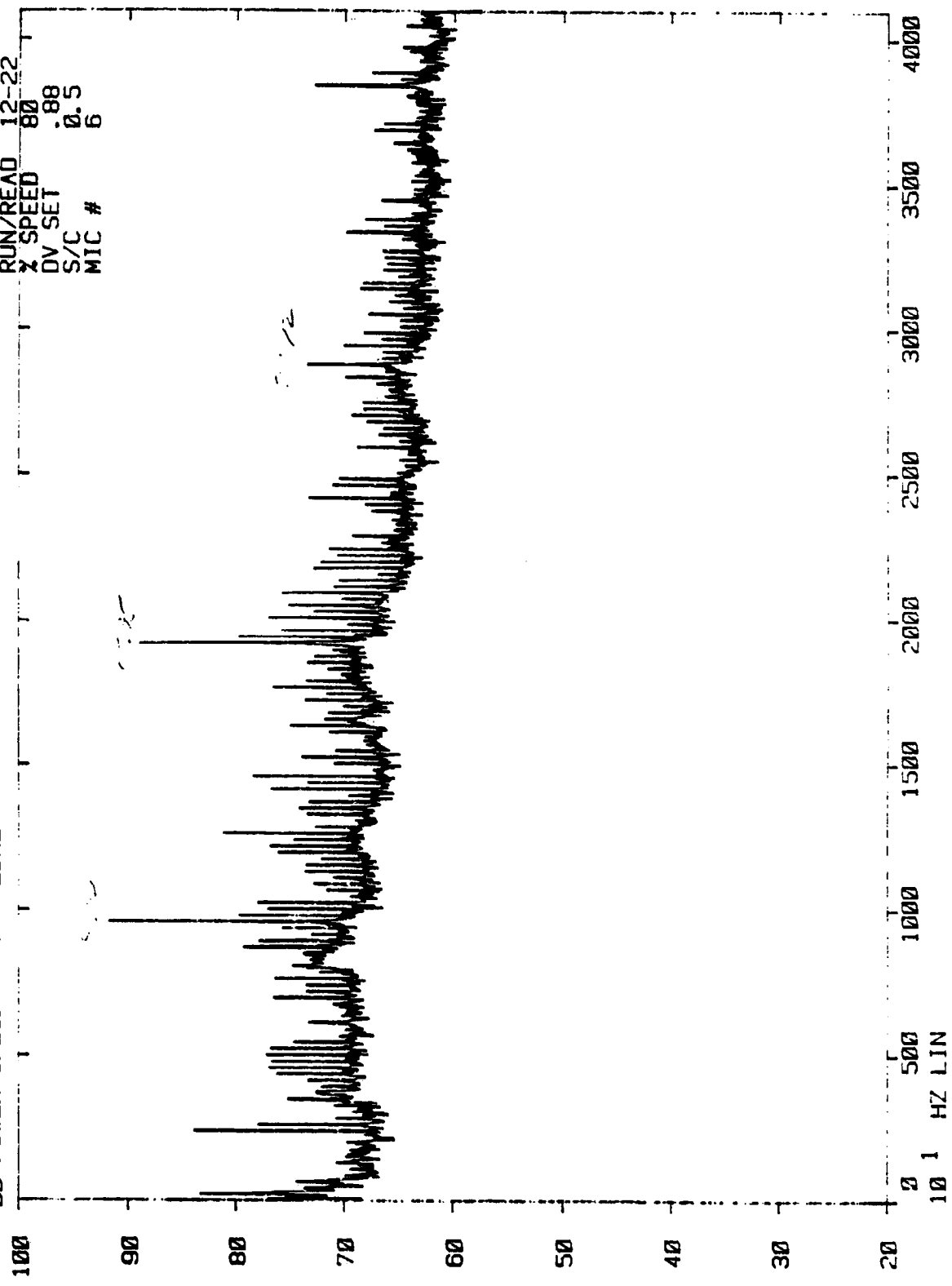


NASA V/B STUDY
48 VANE SET

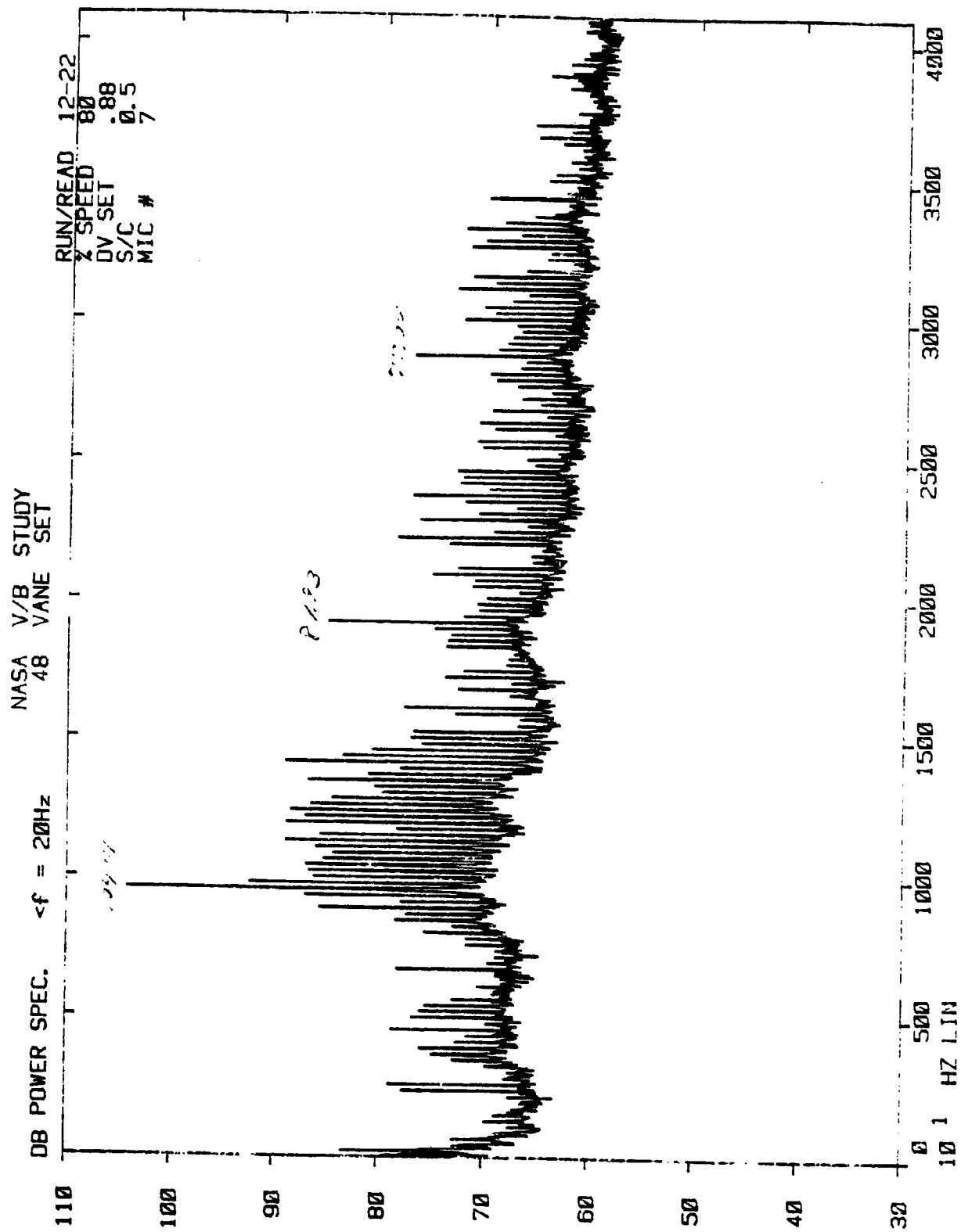
<f = 20Hz

DB POWER SPEC.

RUN/READ 12-22
X SPEED 80
DV SET .88
S/C 0.5
MIC # 6



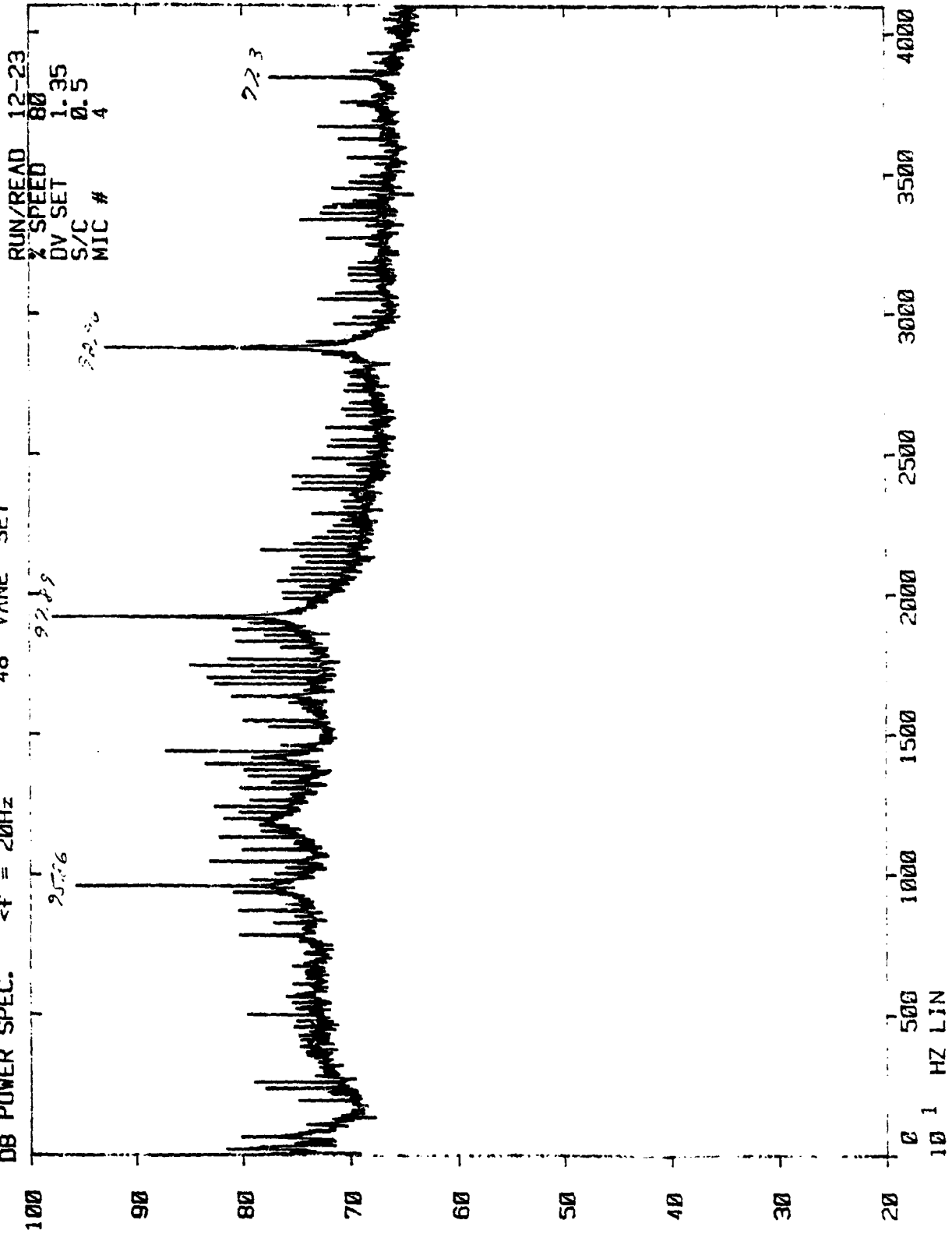
✓

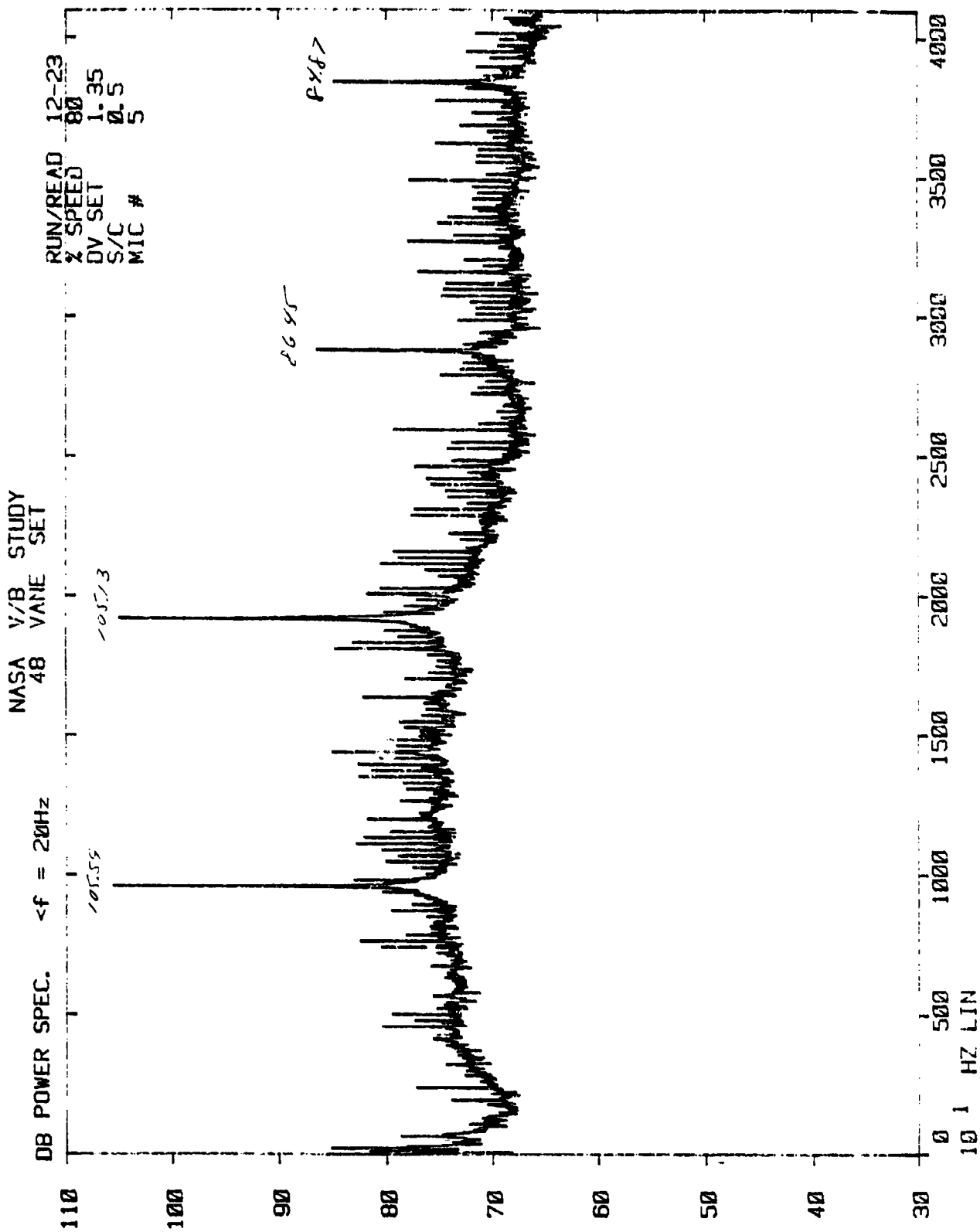


NASA V/B STUDY
48 VANE SET

<f = 20Hz

DB POWER SPEC.

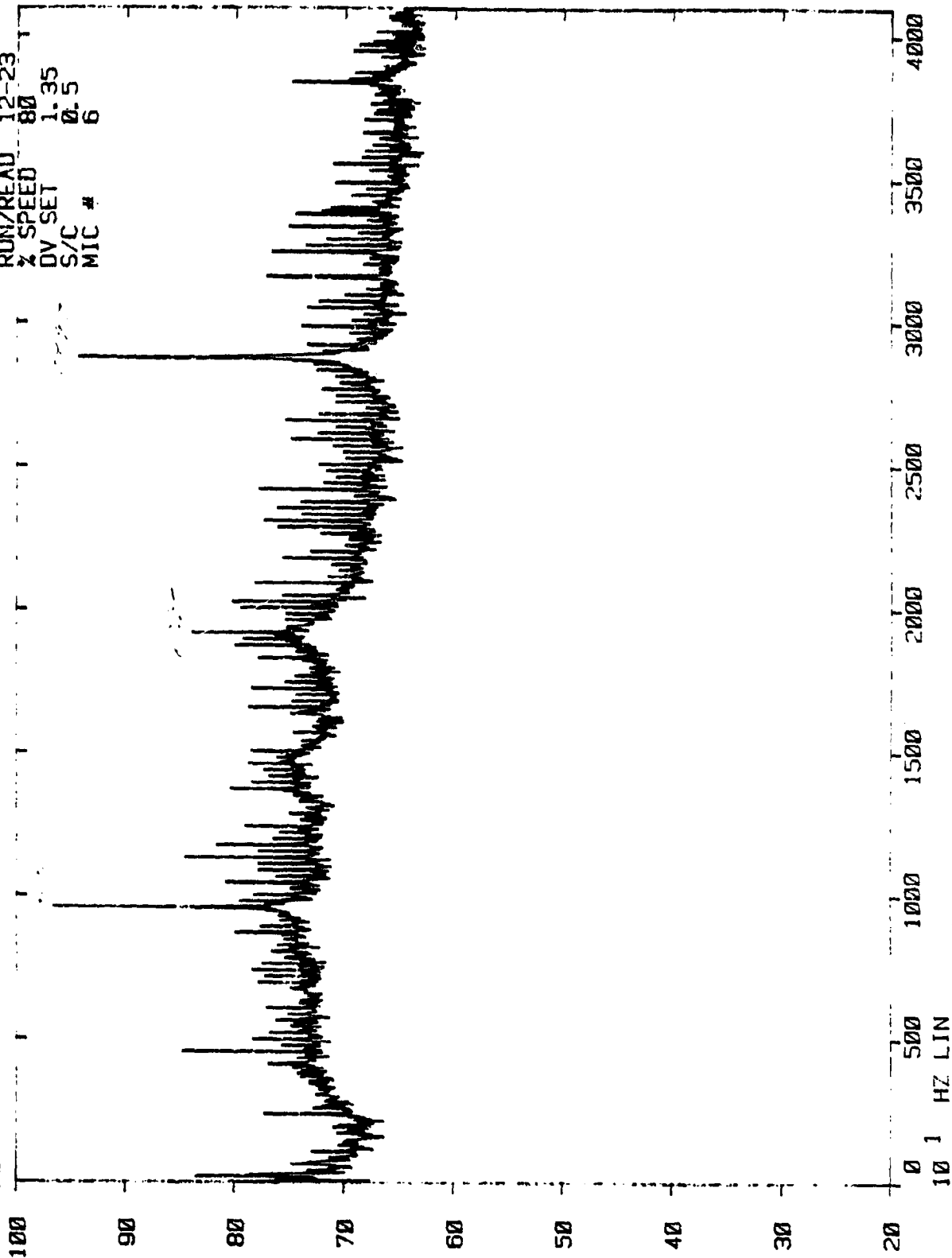


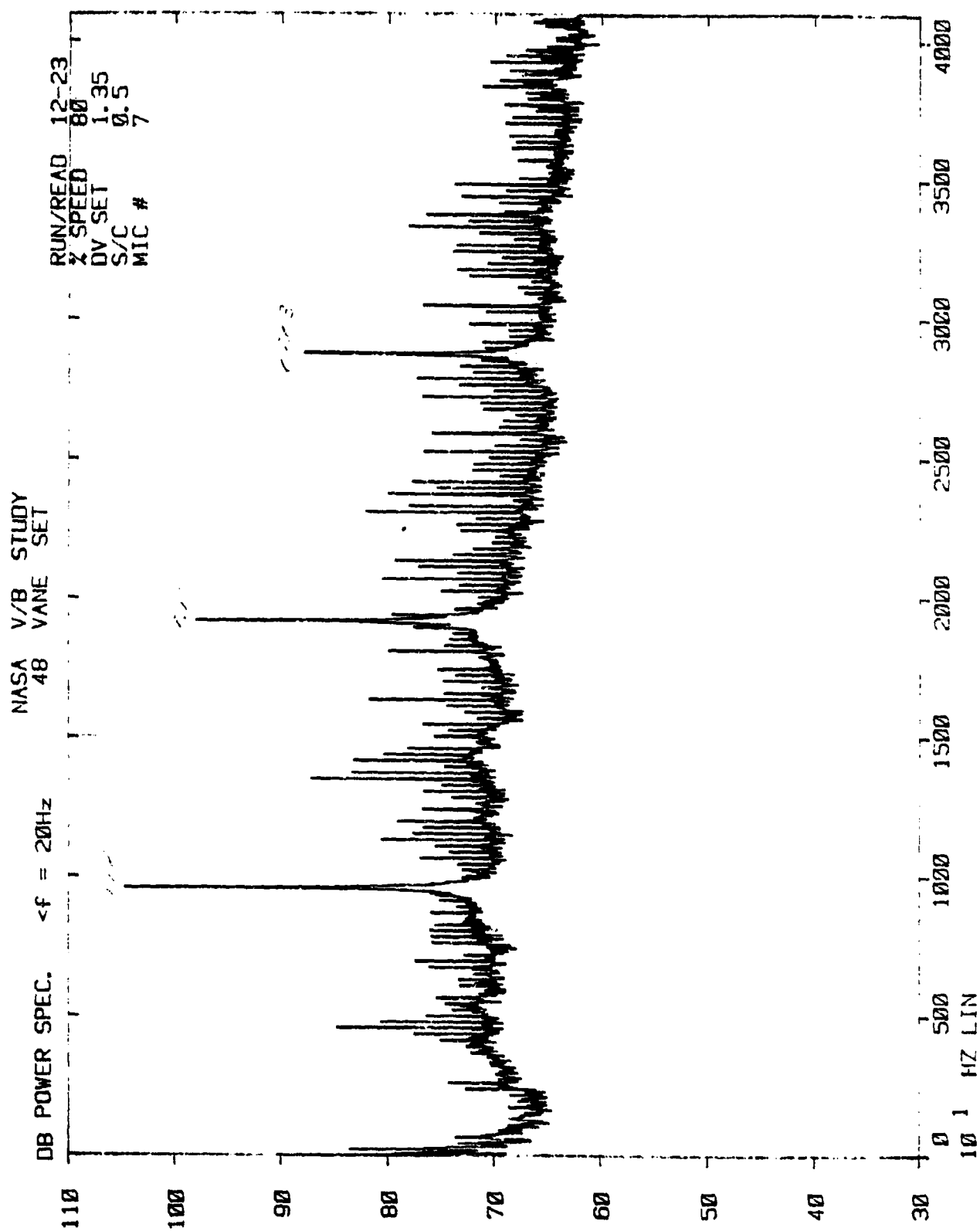


NASA V/B STUDY
48 VANE SET

<f = 20Hz

DB POWER SPEC.

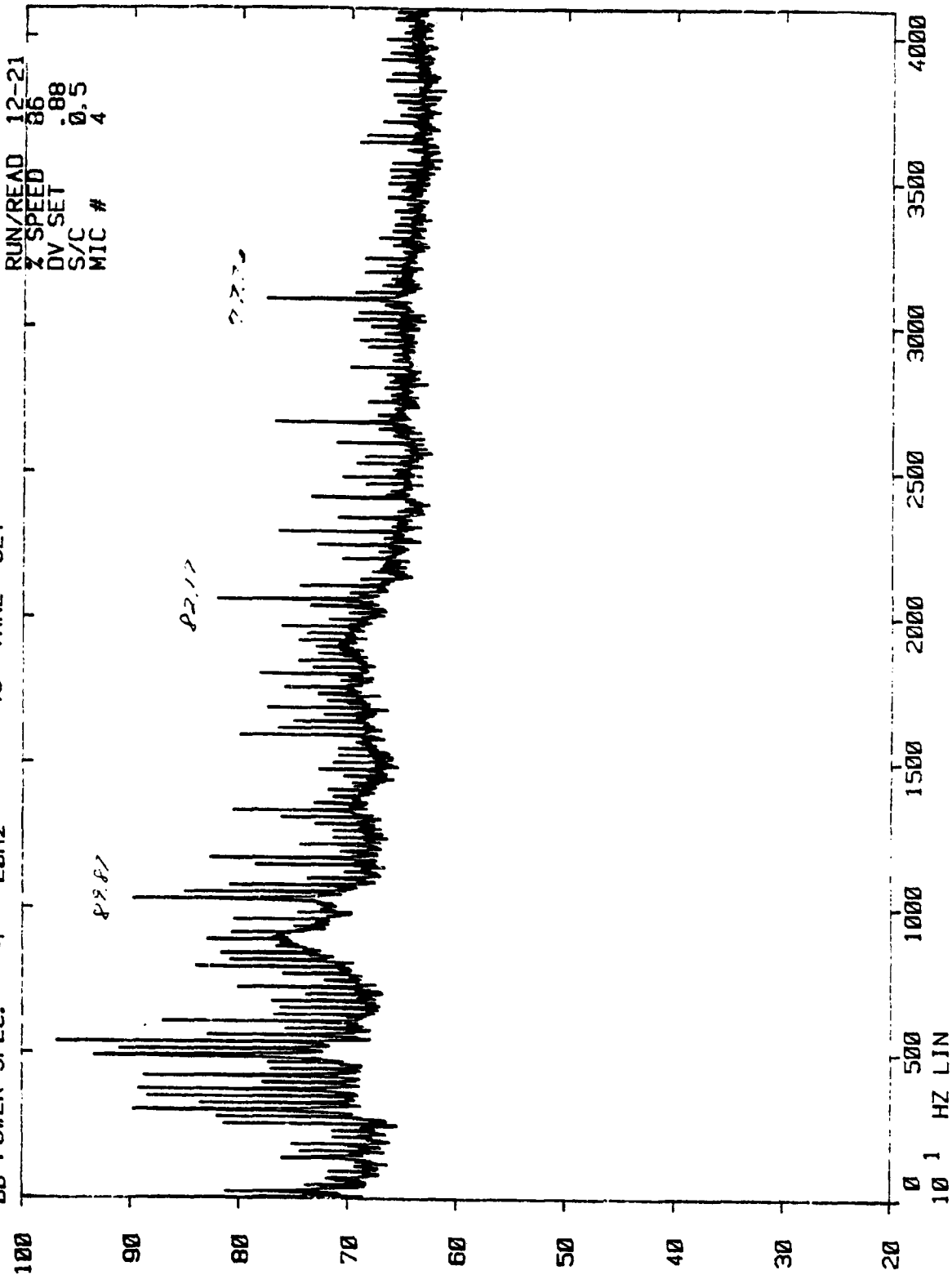


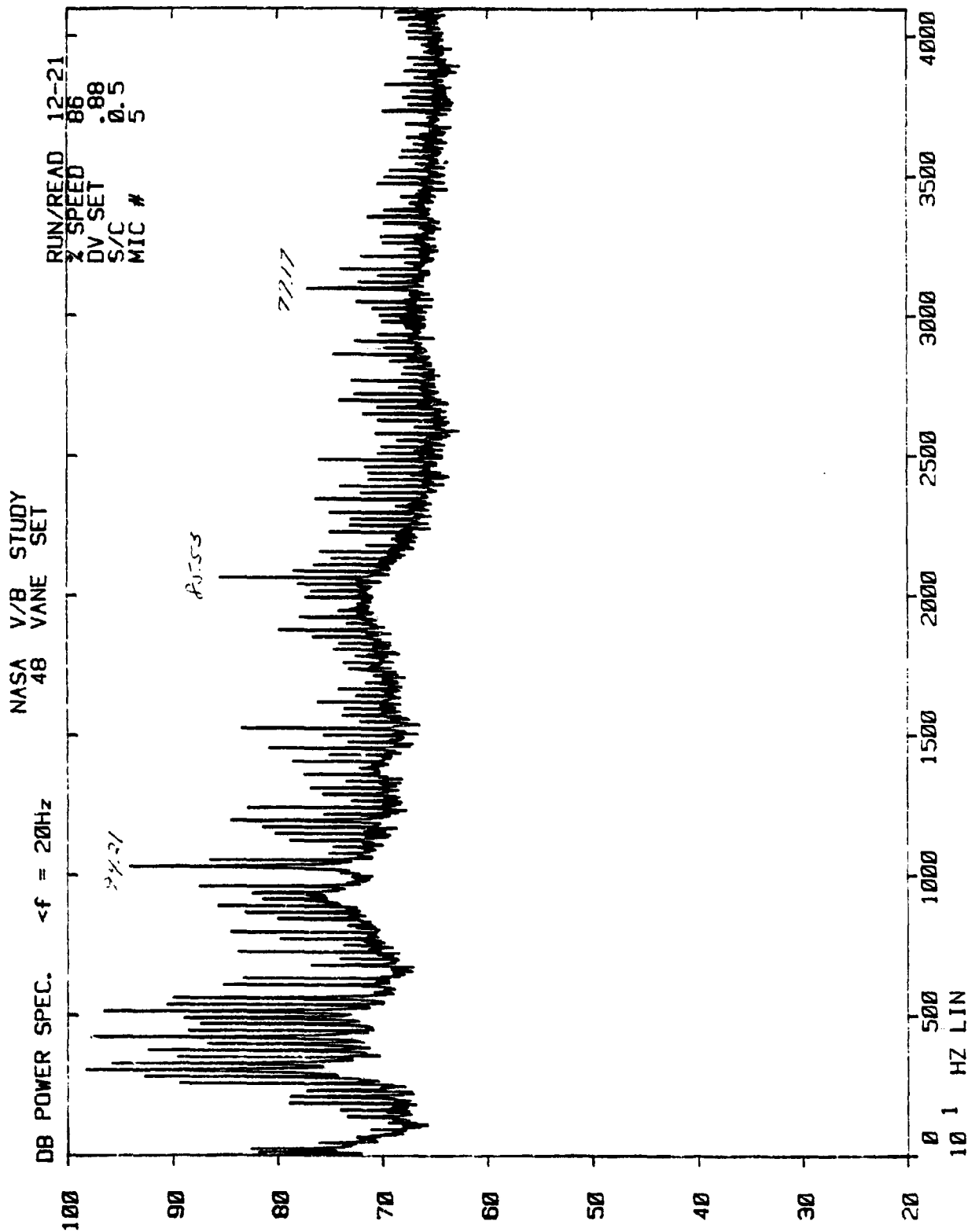


NASA V/B STUDY
48 VANE SET

<f = 20Hz

DB POWER SPEC.

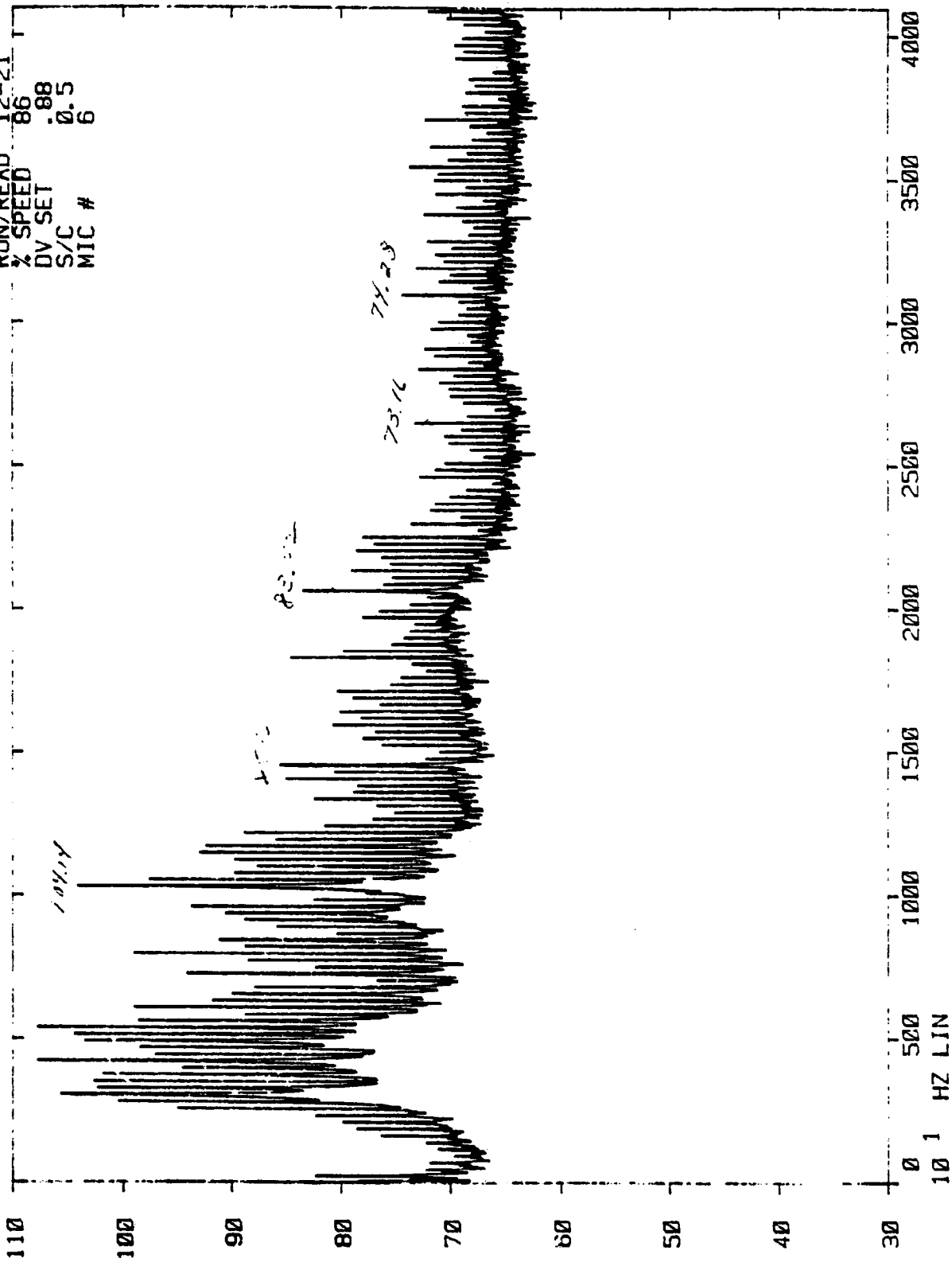




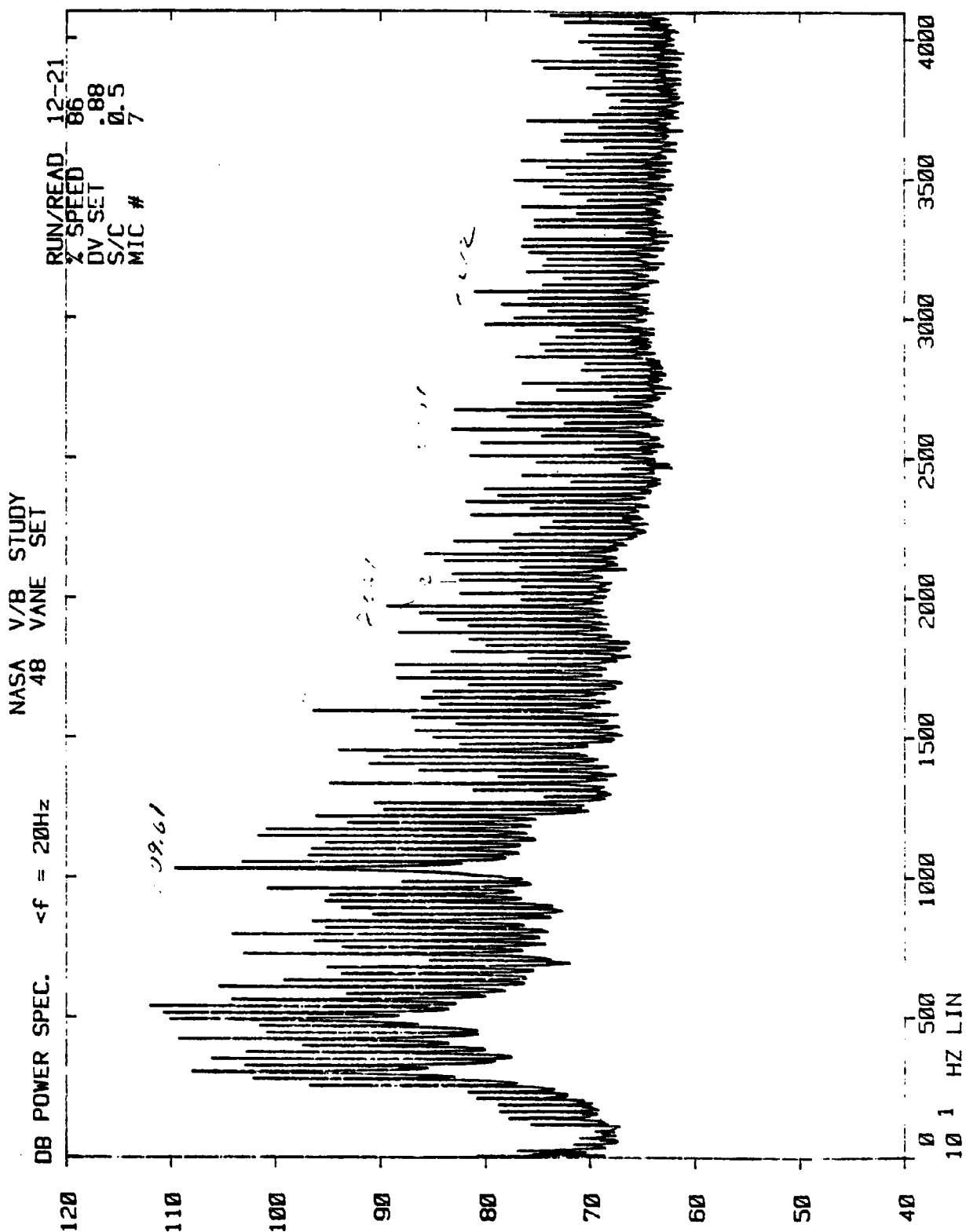
NASA V/B STUDY
48 VANE SET

DB POWER SPEC. <f = 20Hz

RUN/READ 12-21
% SPEED 86
DV SET .88
S/C 0.5
MIC # 6



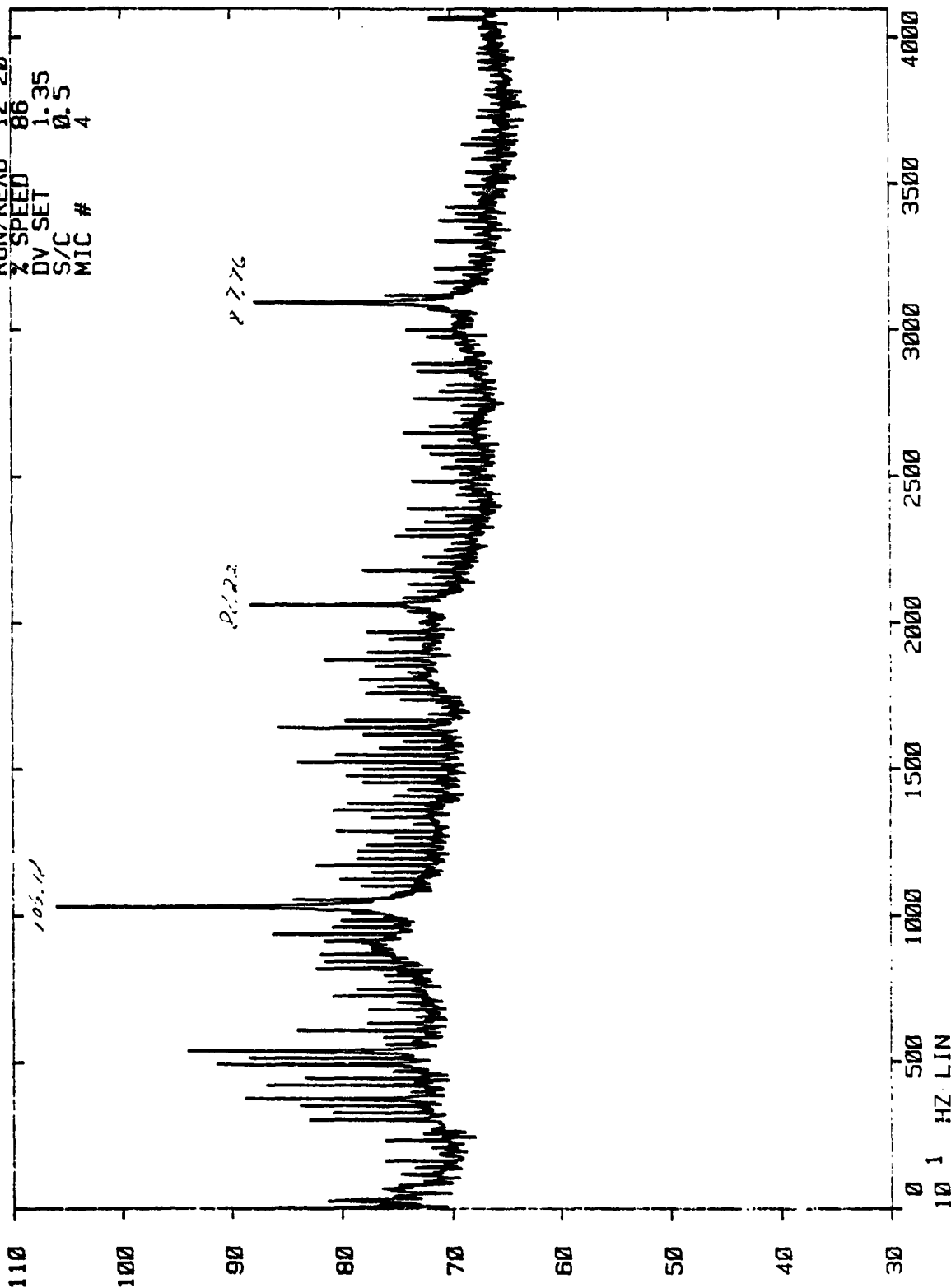
✓

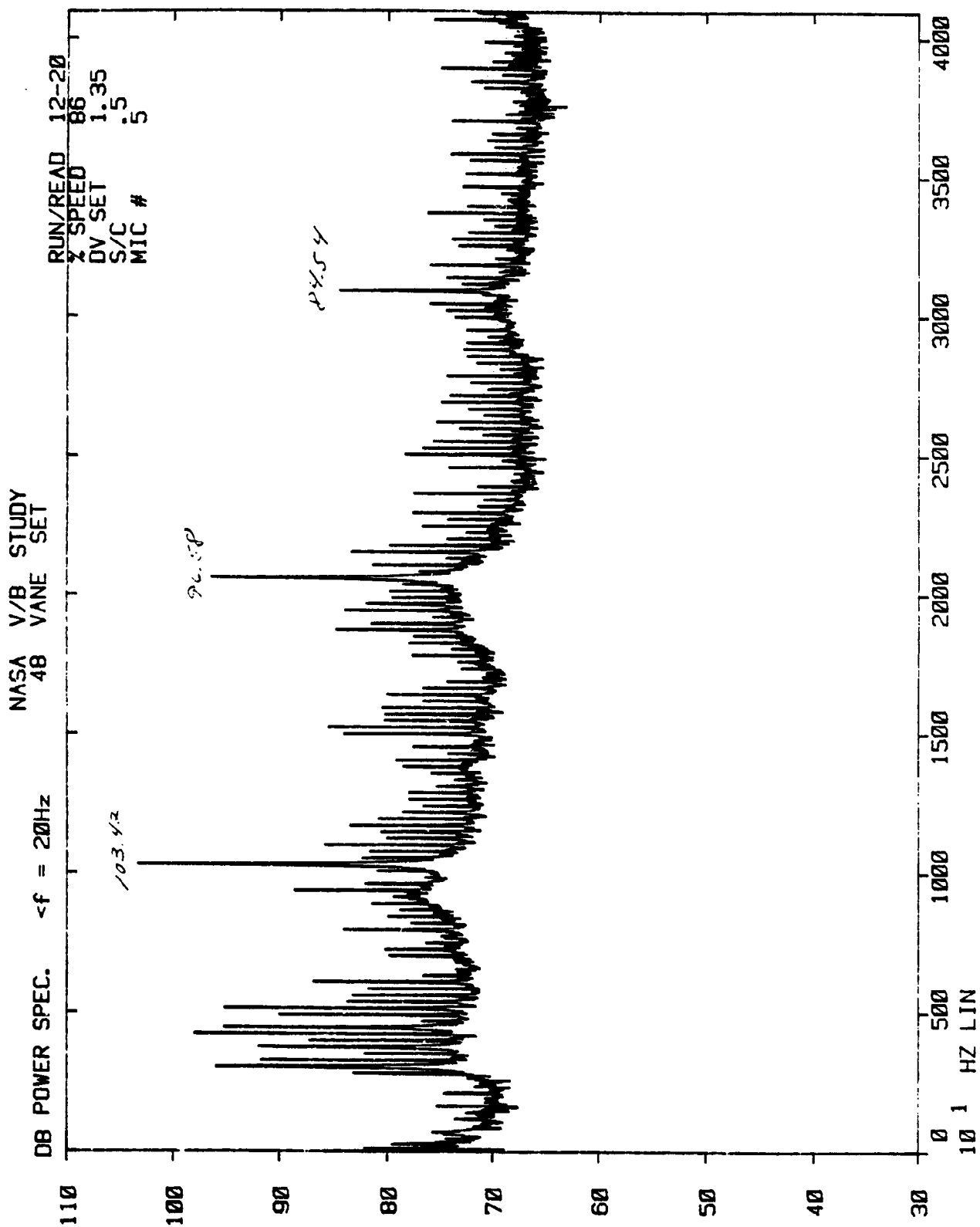


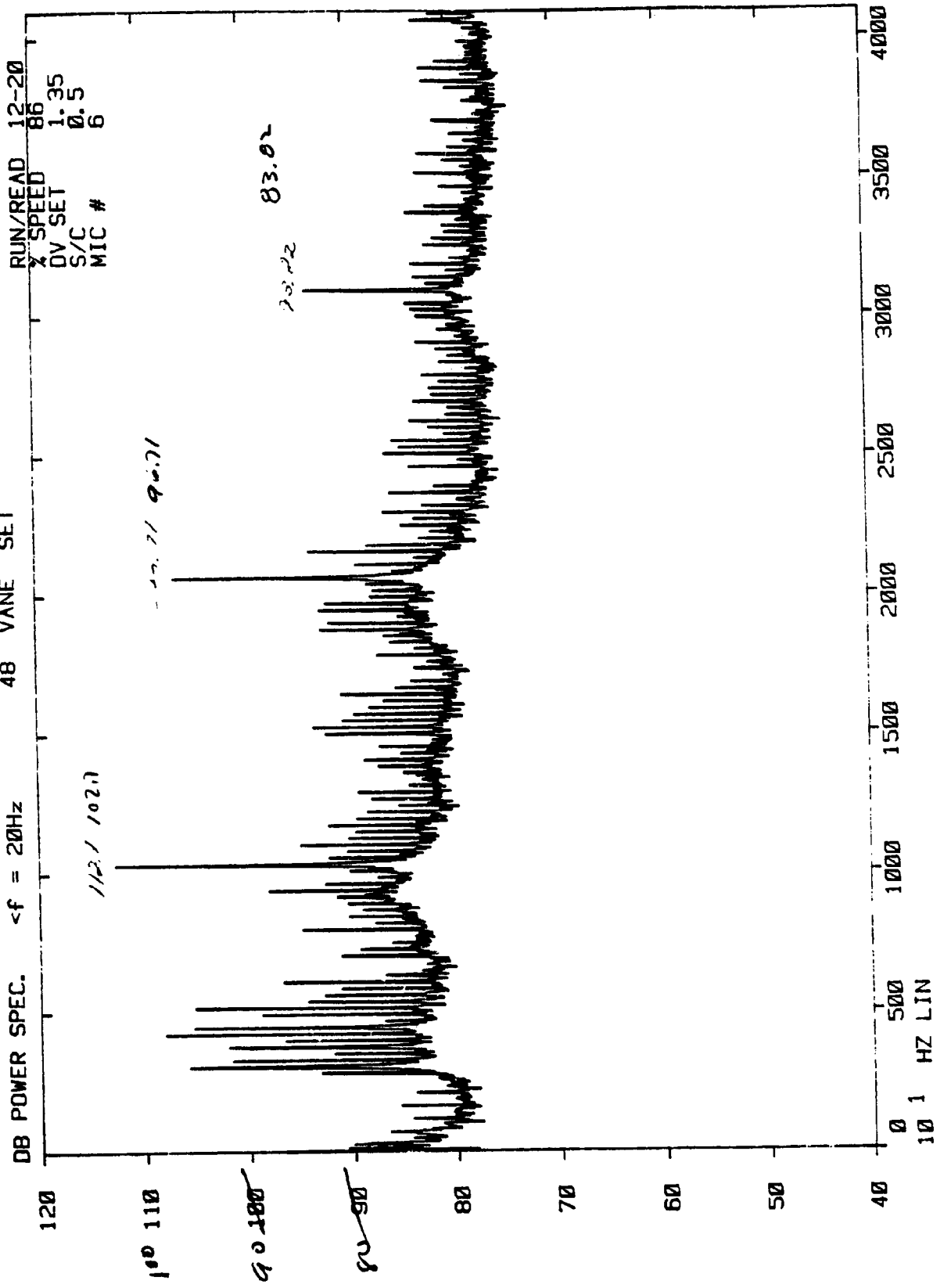
NASA V/B STUDY
48 VANE SET

DB POWER SPEC. <f = 20Hz

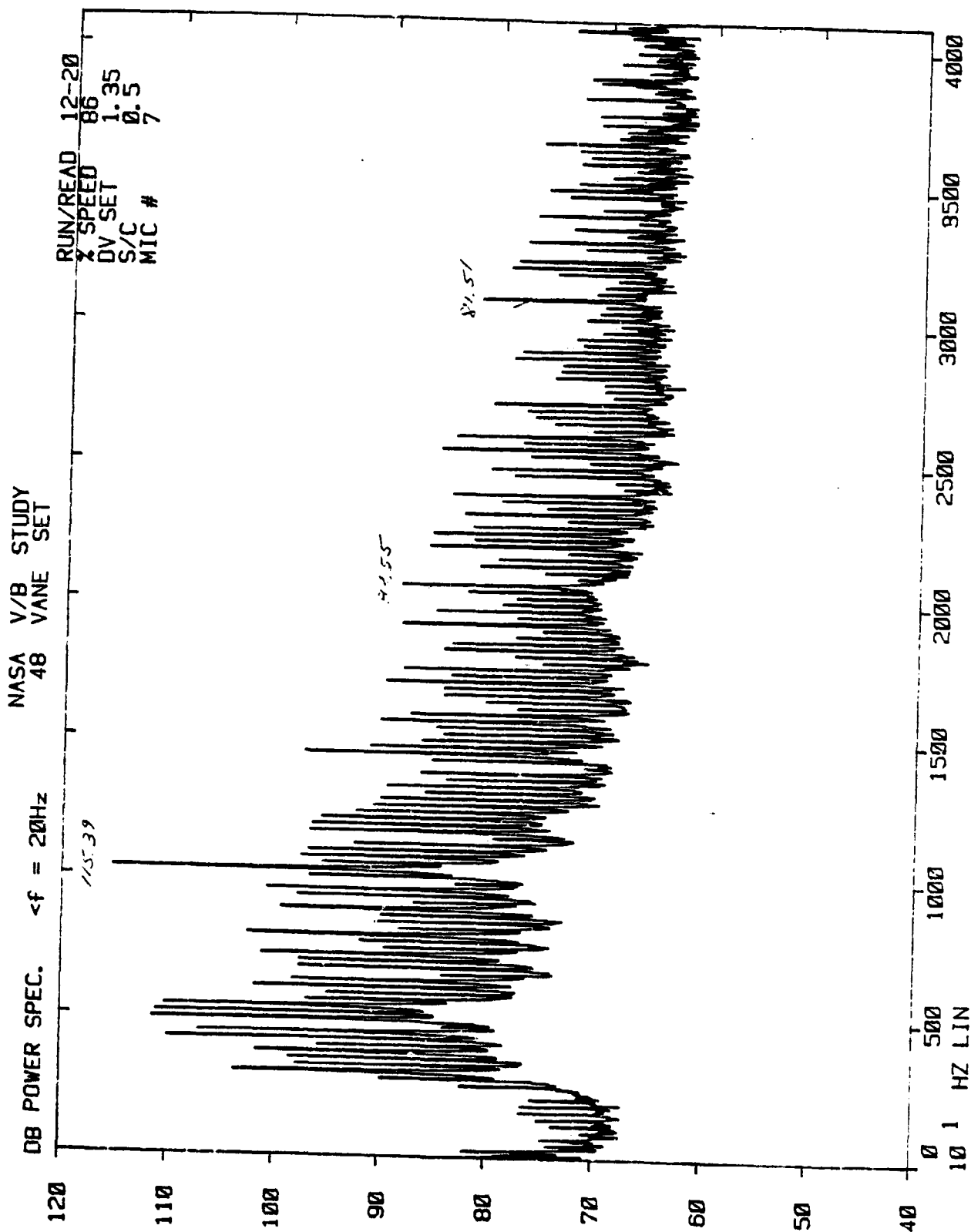
RUN/READ 12-20
% SPEED 86
DV SET 1.35
S/C 0.5
MIC # 4

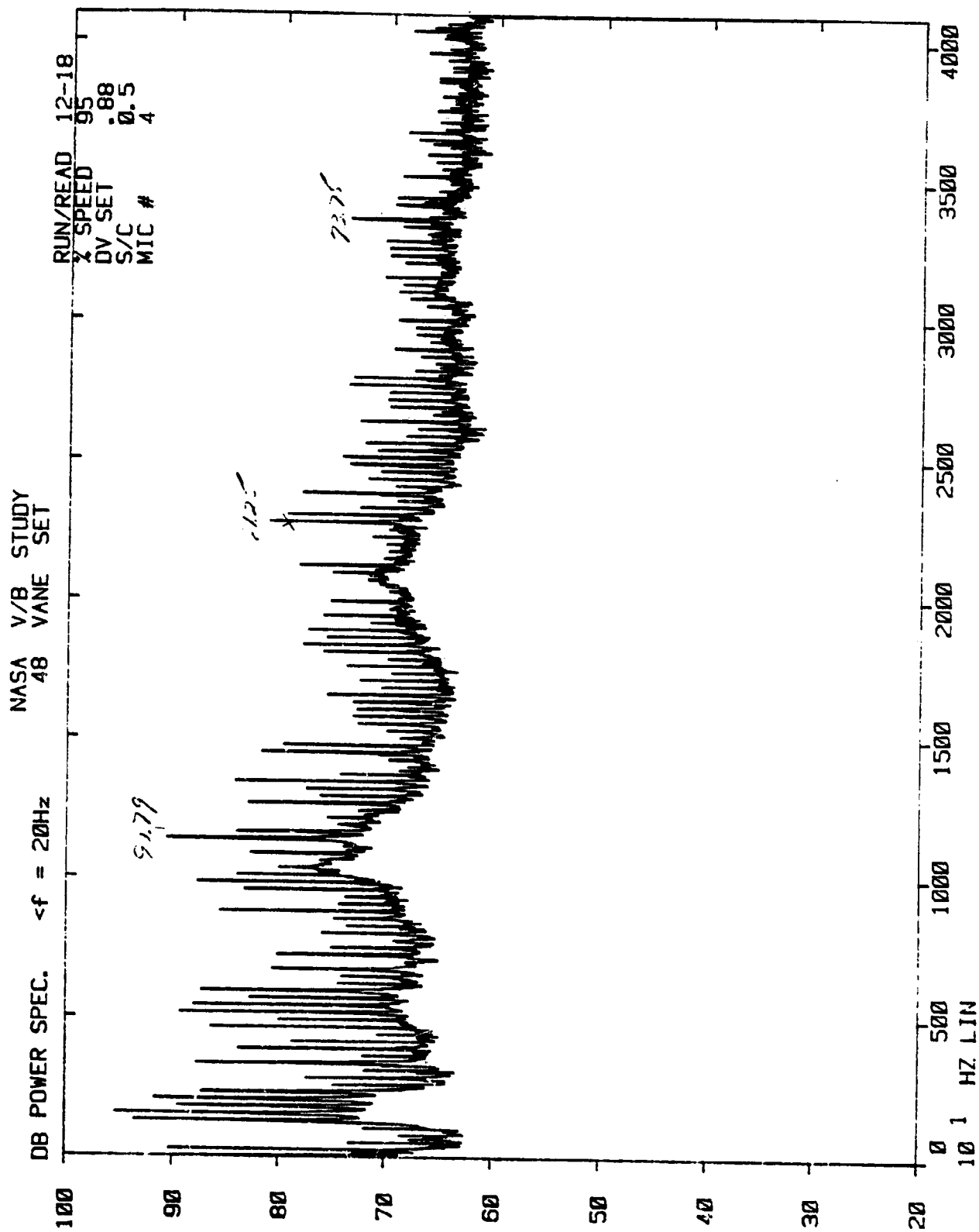


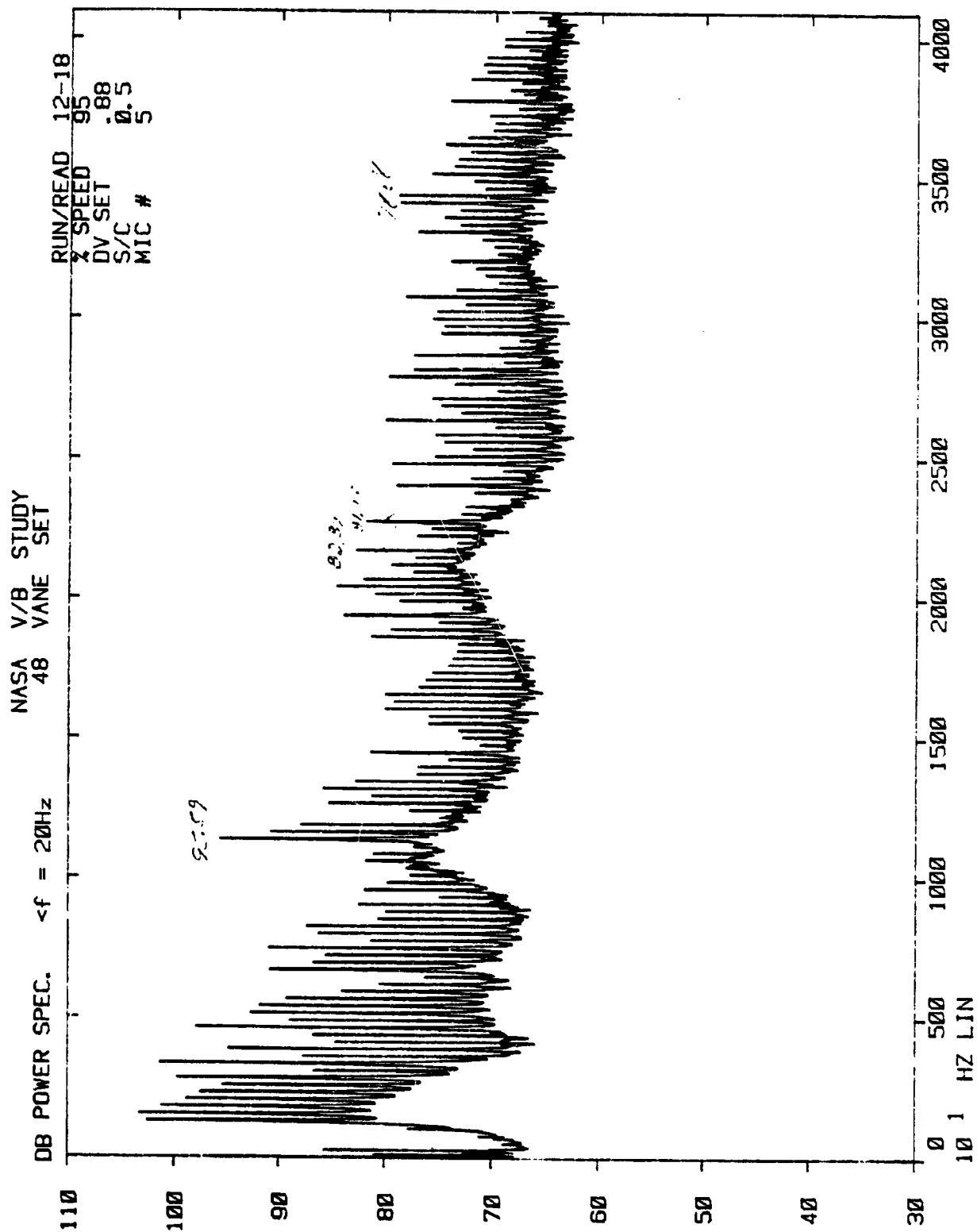


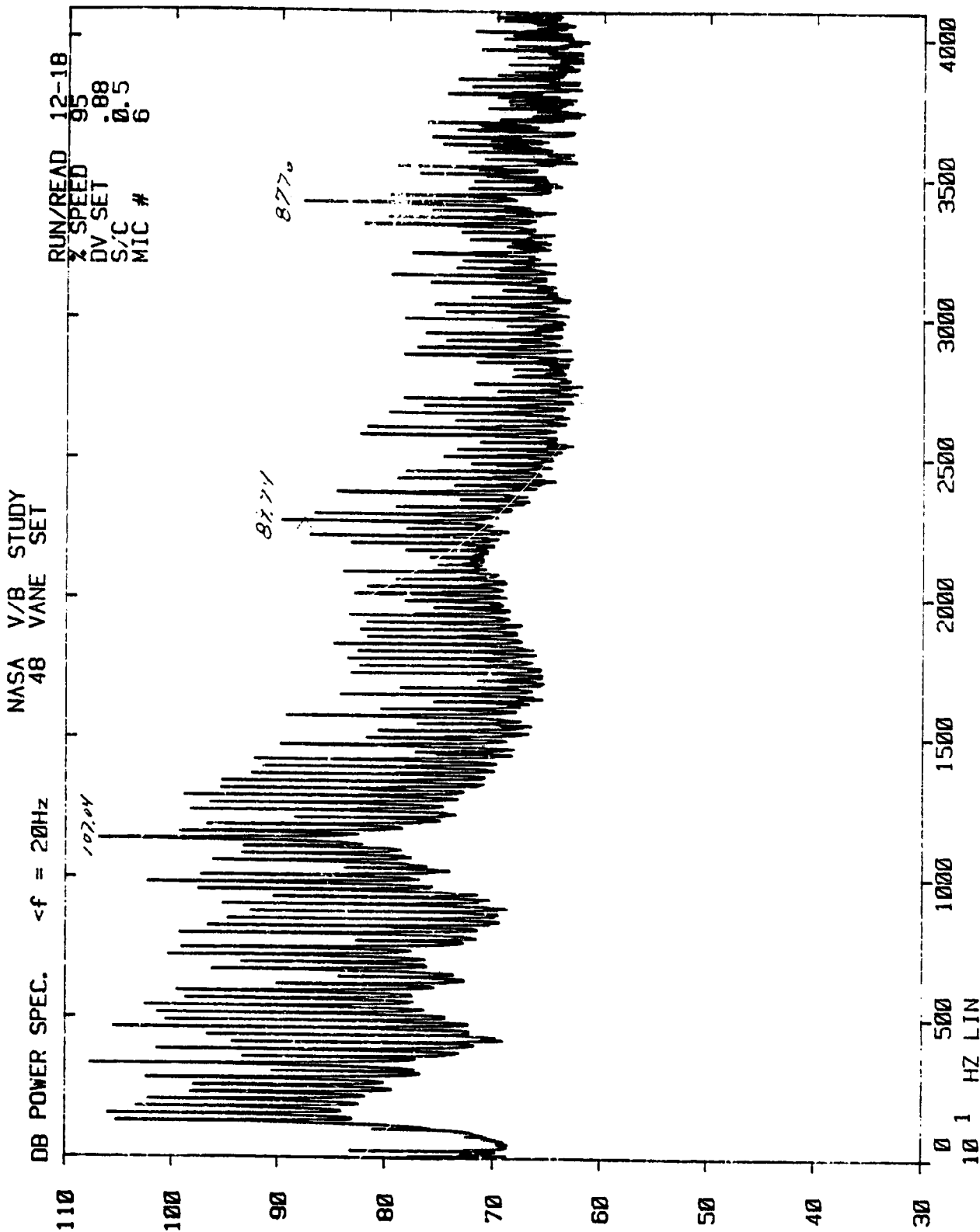


✓
110 dB
110 Hz
120 Hz





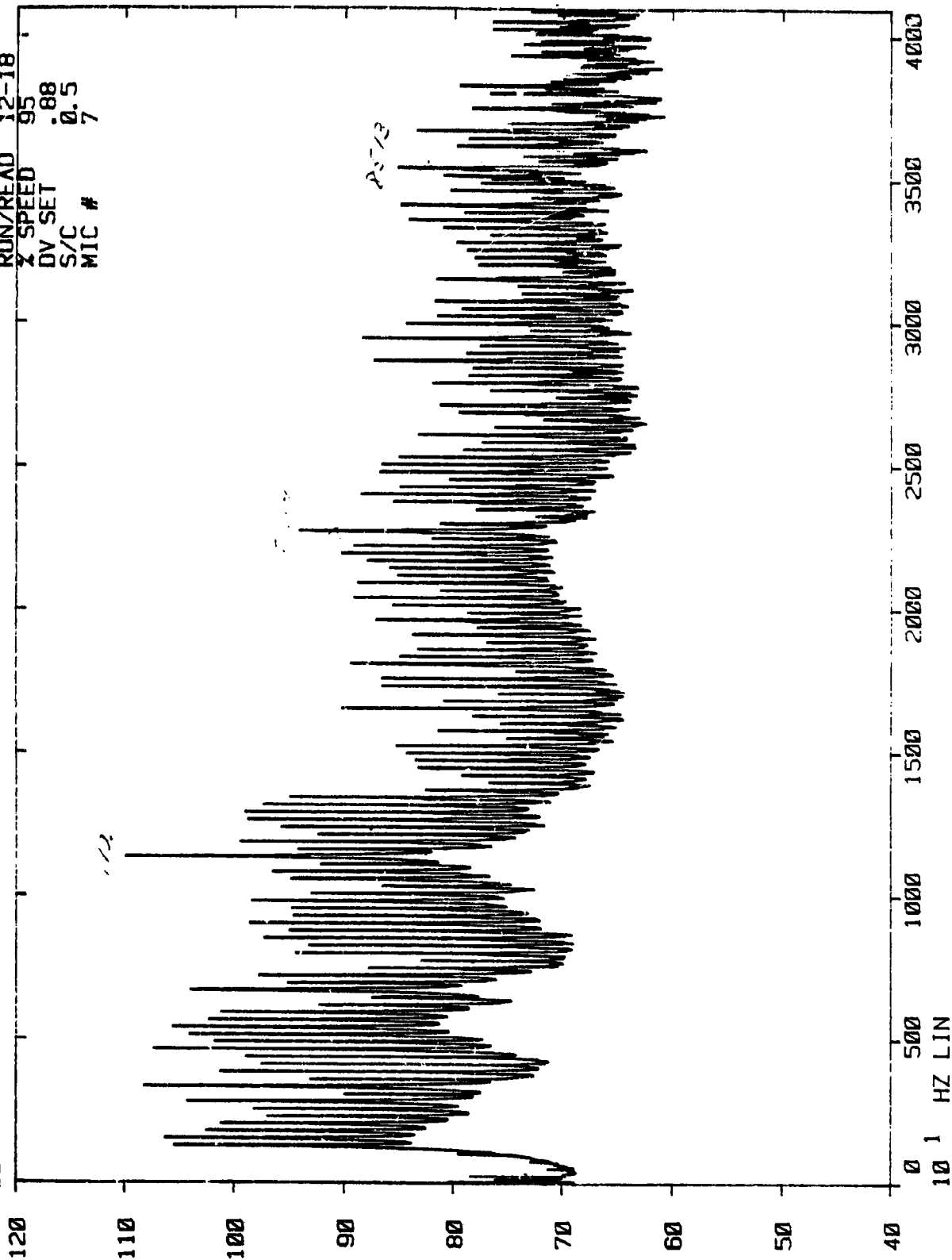




NASA V/B STUDY
48 VANE SET

DB POWER SPEC. $\Delta f = 20\text{Hz}$

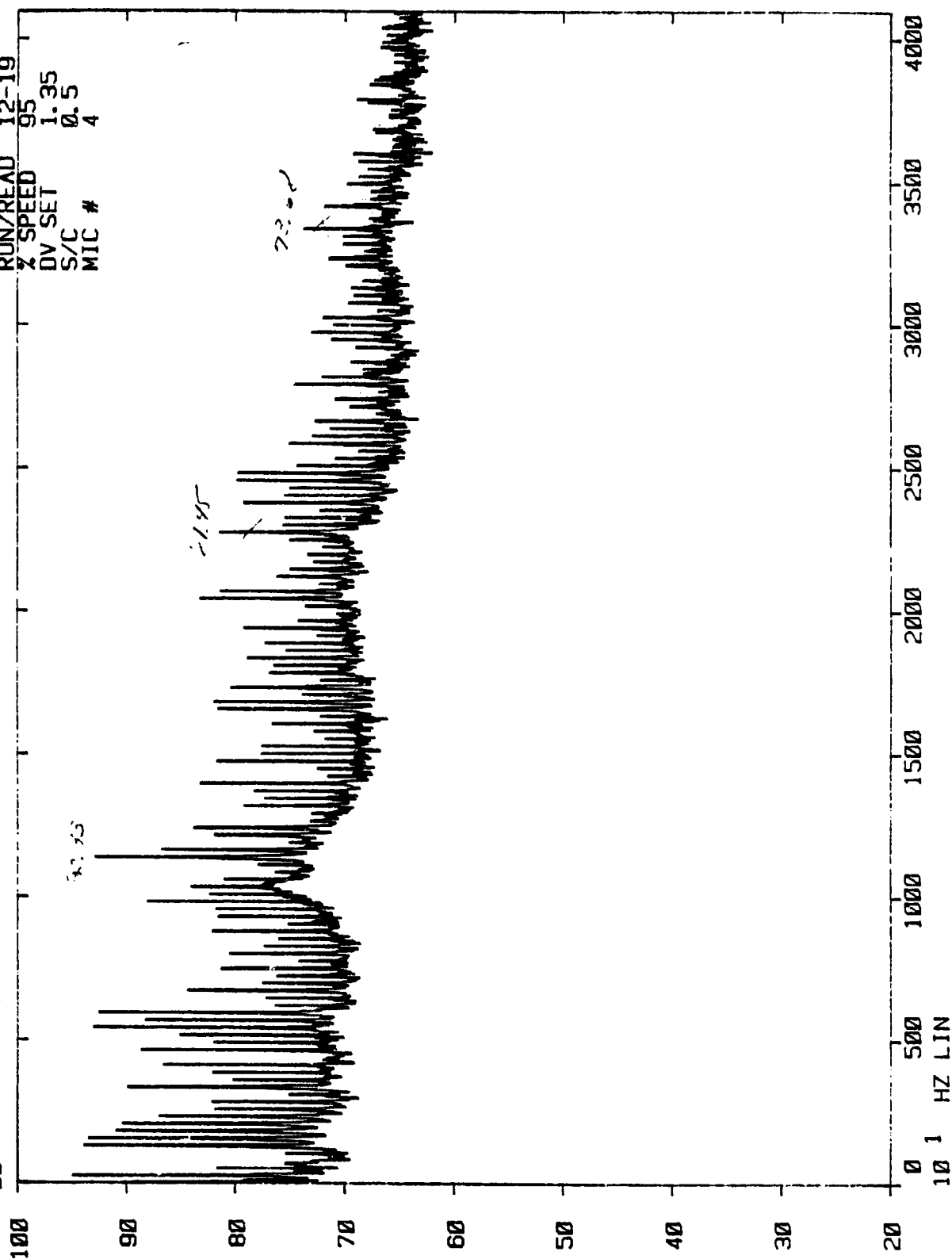
RUN/READ 12-18
Z SPEED 95
DV SET .88
S/C 0.5
MIC # 7

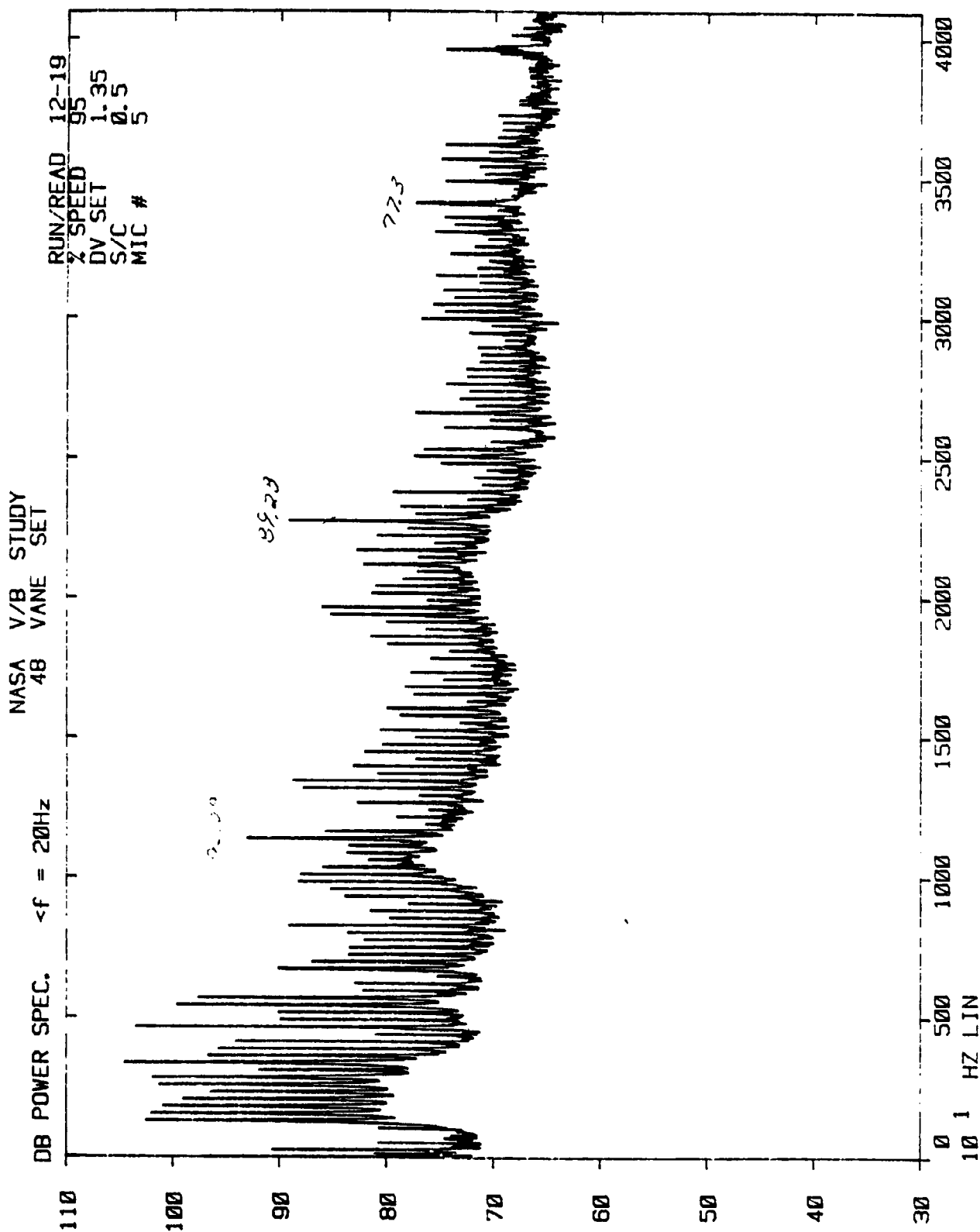


NASA V/B STUDY
48 VANE SET

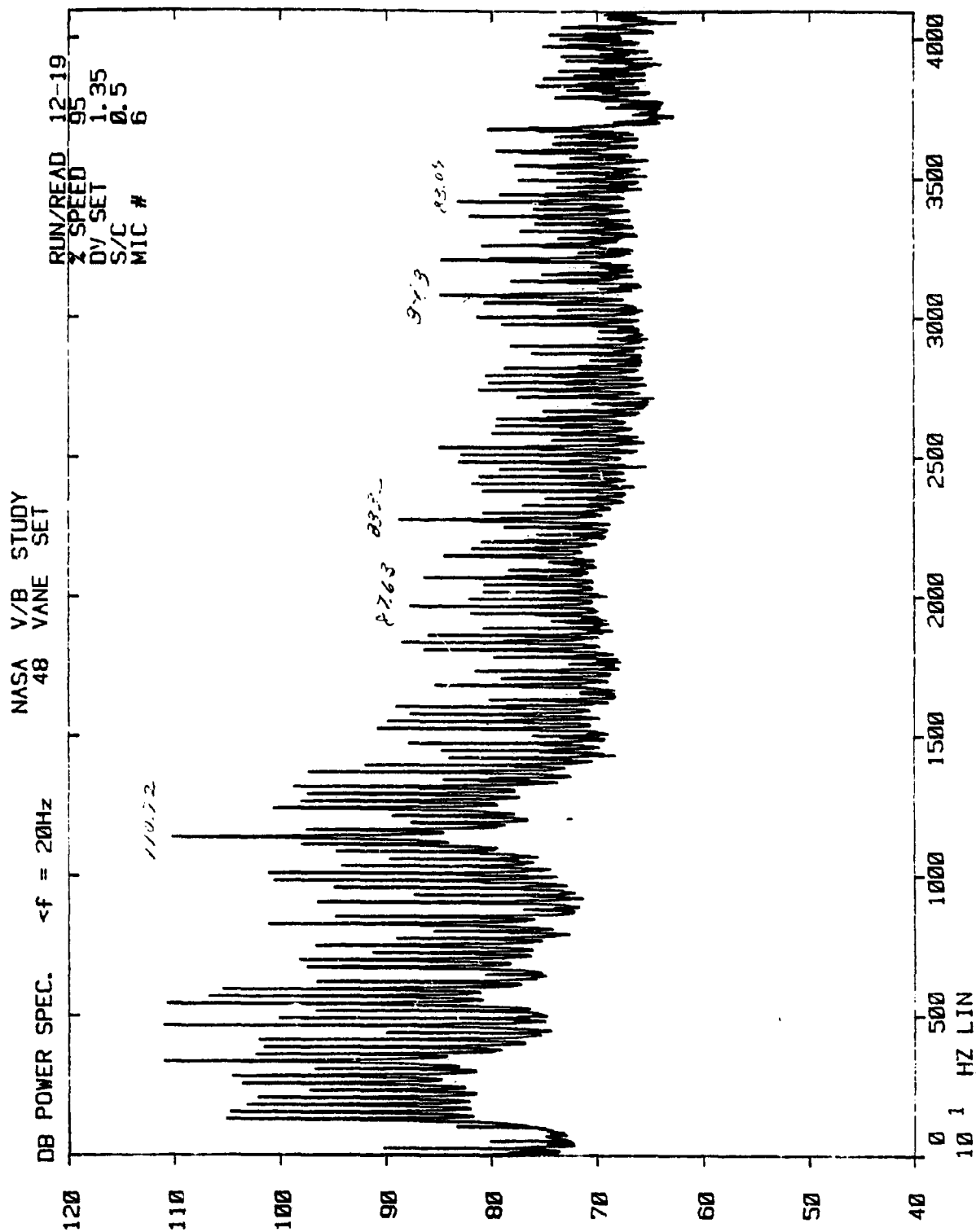
DB POWER SPEC. $< f = 20\text{Hz}$

RUN/READ 12-19
Z SPEED 95
DV SET 1.35
S/C 0.5
MIC # 4

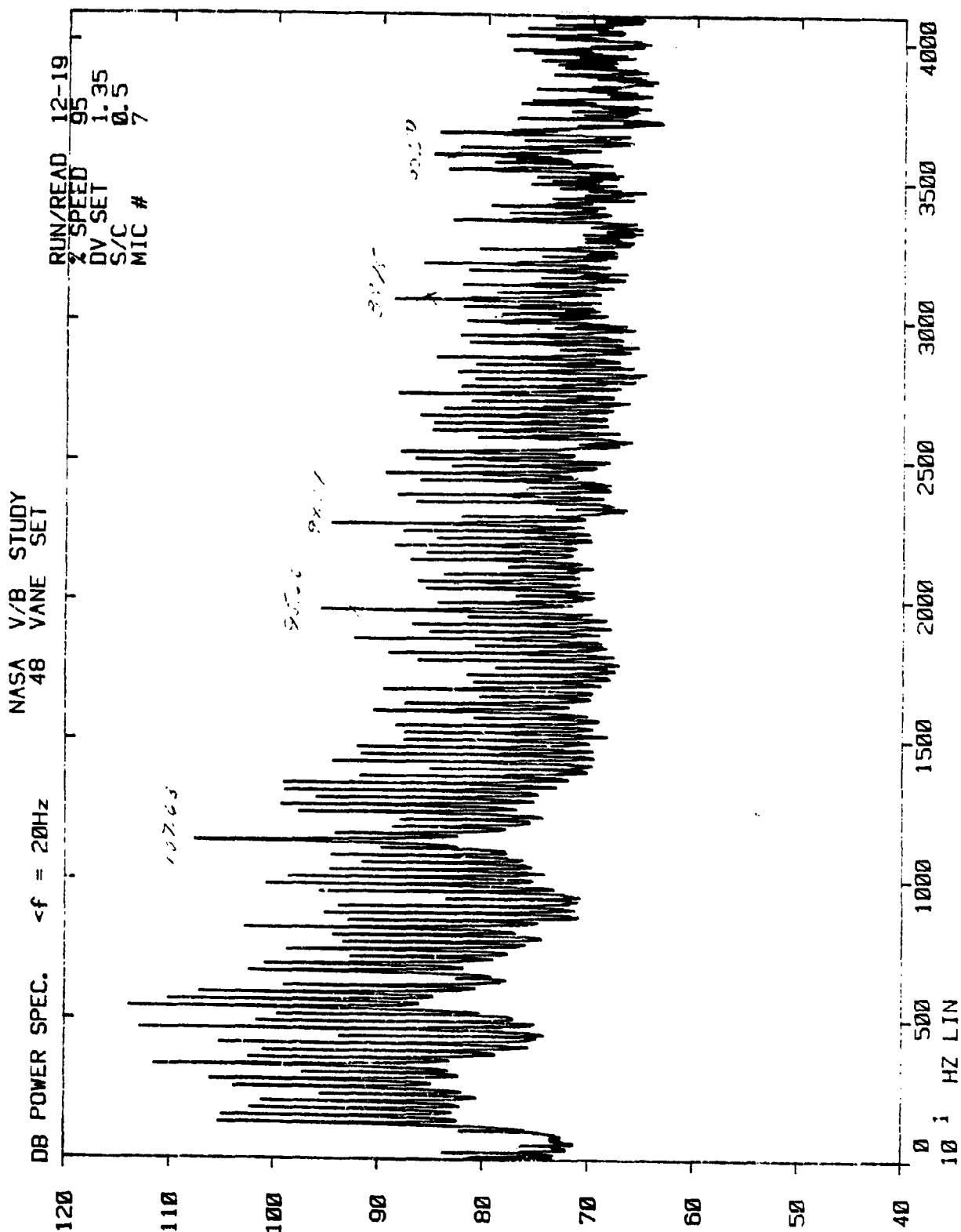




✓
12-19



Log 2.44



NASA V/B STUDY
48 VANE SET

<f = 20Hz

DB POWER SPEC.

12-17

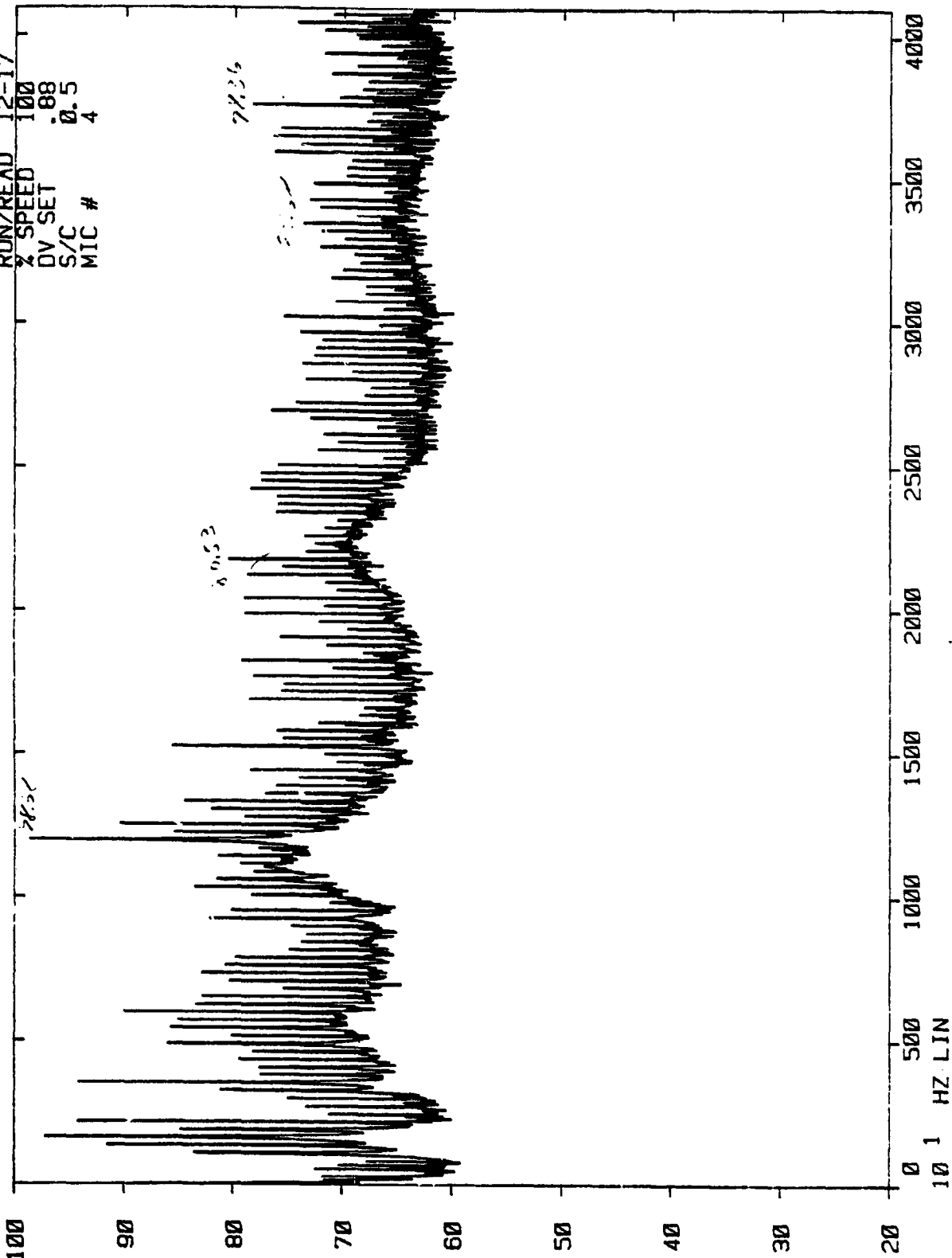
RUN/READ

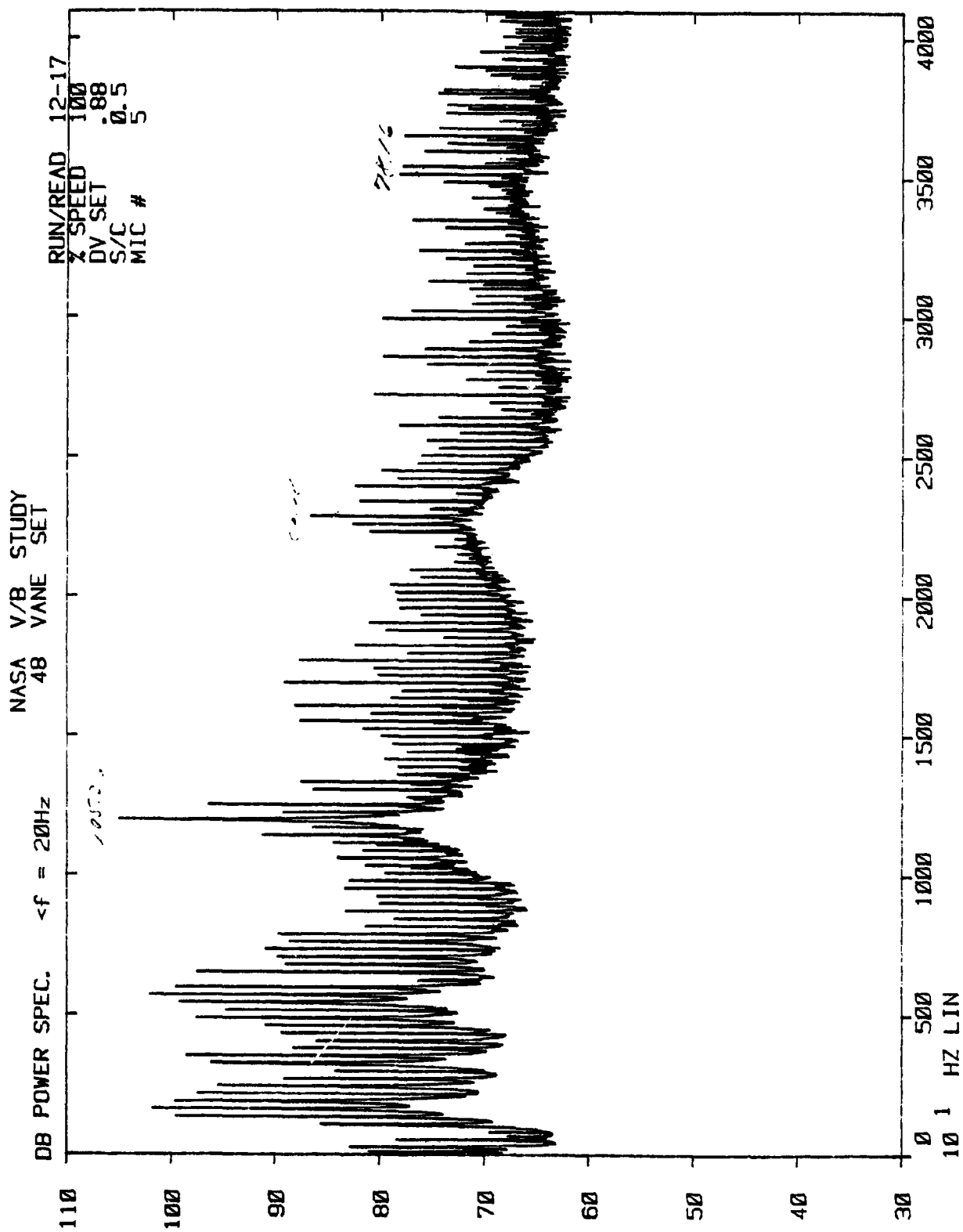
7 SPEED 100

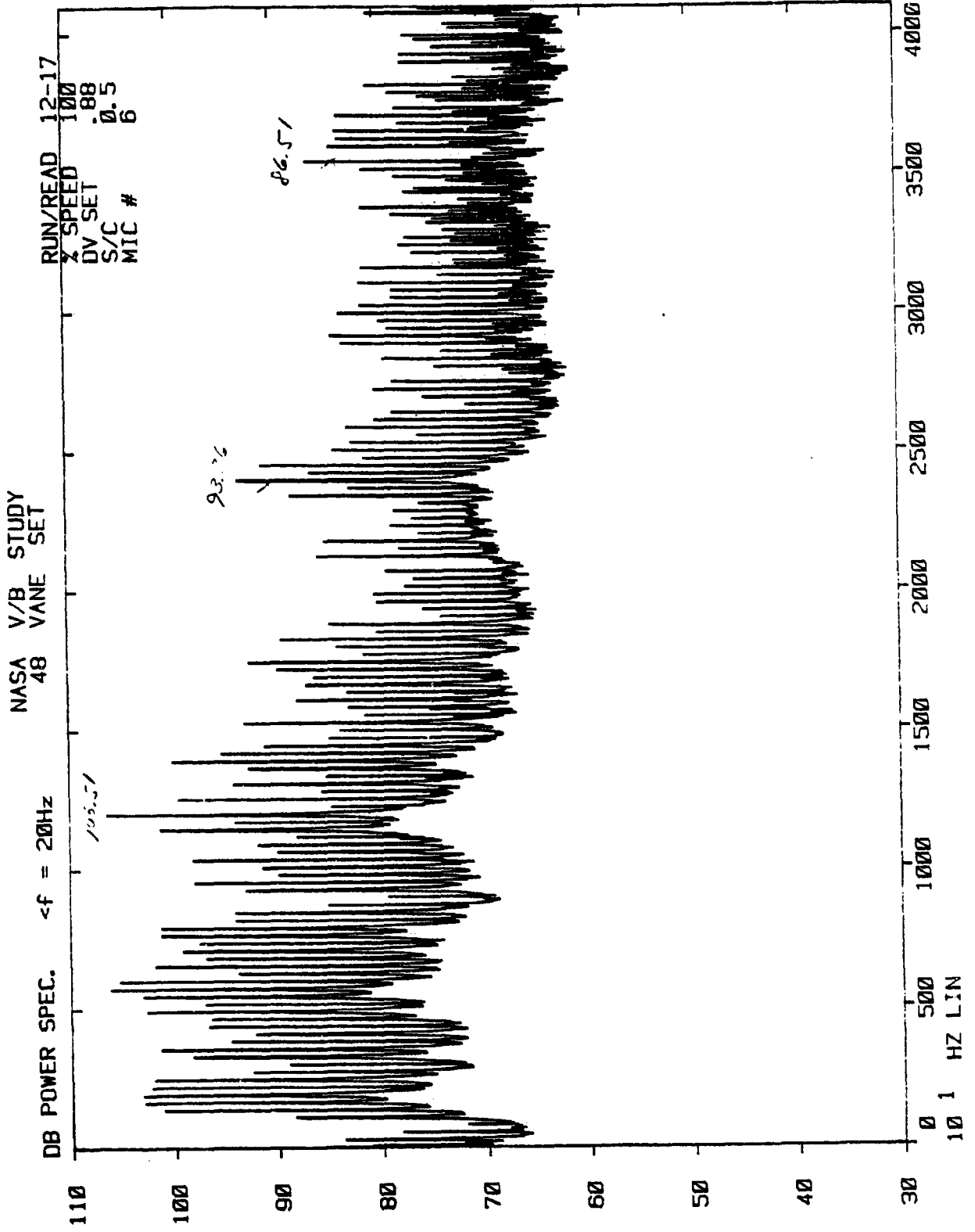
DV SET .88

S/C 0.5

MIC # 4







NASA V/B STUDY
48 VANE SET

<f = 20Hz

DB POWER SPEC.

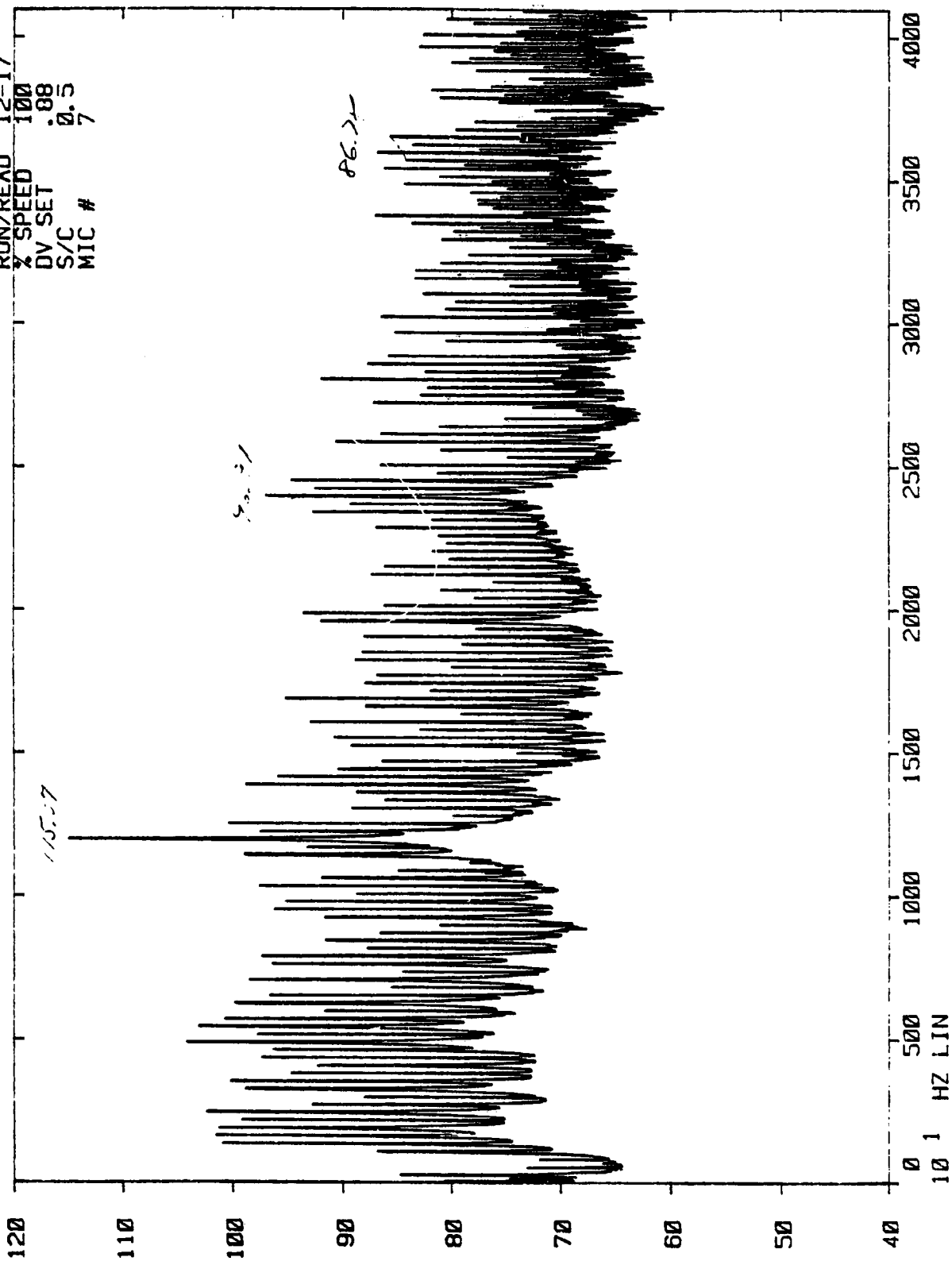
RUN/READ 12-17

% SPEED 100

DV SET .08

S/C 0.5

MIC # 7

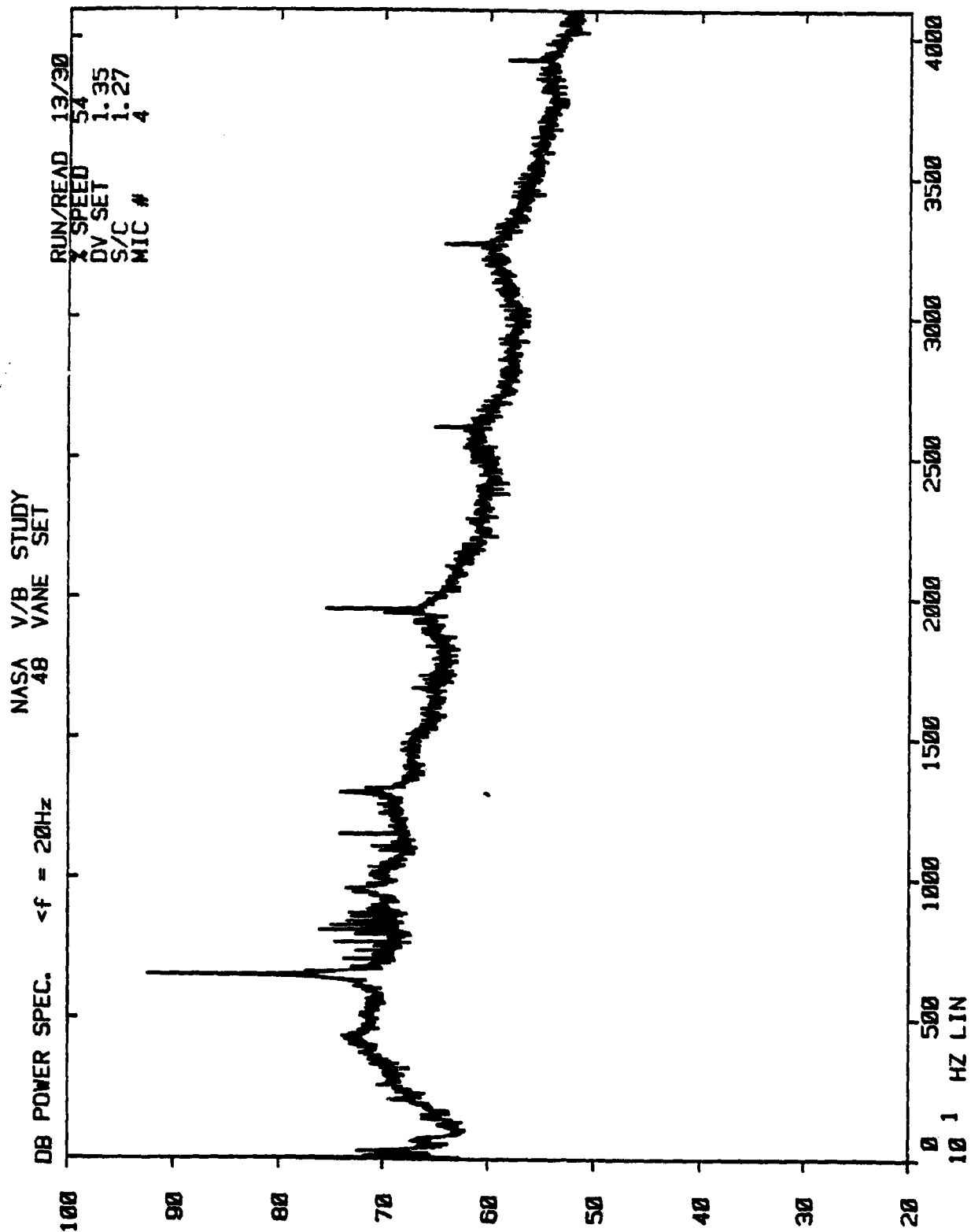


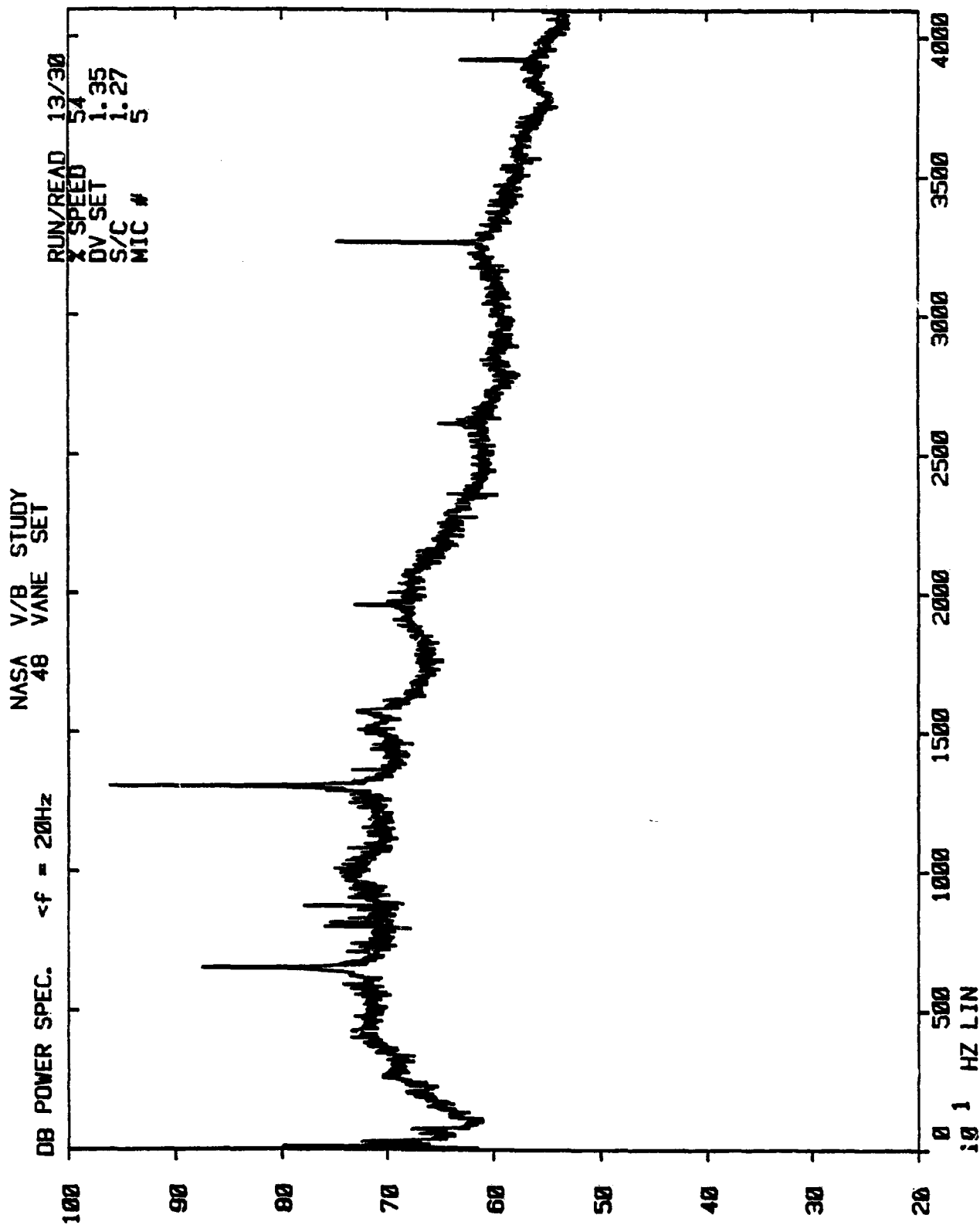
NARROWBAND SPECTRA (20 Hz.)

MICROPHONES 4 THRU 7 (30° THRU 60°)

• 48 VANES, $S/C = 1.27$

<u>RUN/RDG.</u>	<u>% N_F</u>	<u>DV</u>	<u>REMARKS</u>
13/2	100	0.95	
13/4	95	0.95	
13/5	95	1.35	
13/8	86	0.95	
13/9	86	1.35	
13/12	76	0.95	
13/13	76	1.35	
13/17	80	1.35	
13/19	80	0.95	
13/20	69	0.95	
13/21	69	1.35	
13/24	63	0.95	
13/25	63	1.35	
13/30	54	1.35	

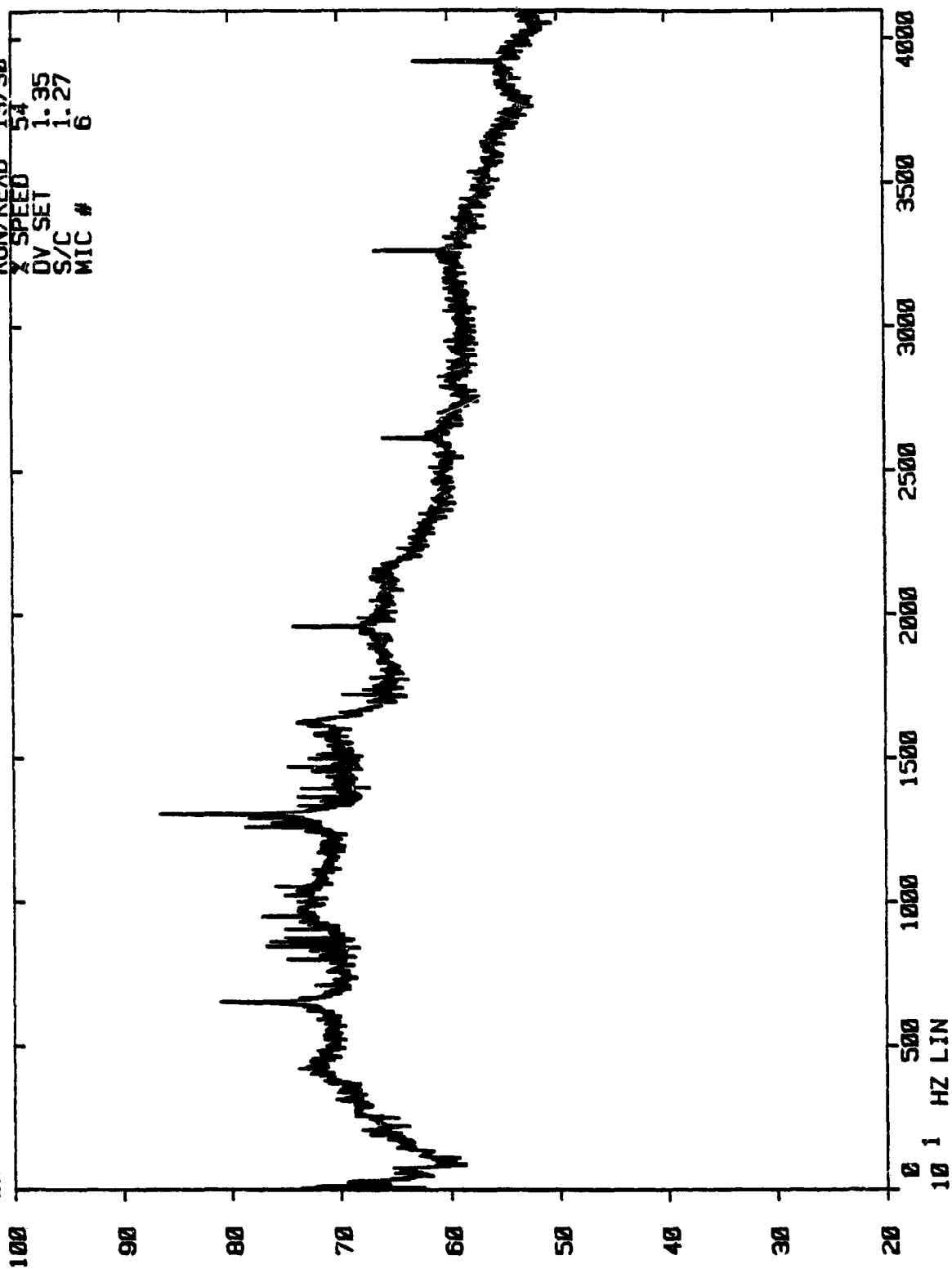




NASA V/B STUDY
48 VANE SET

DB POWER SPEC. <f = 20Hz

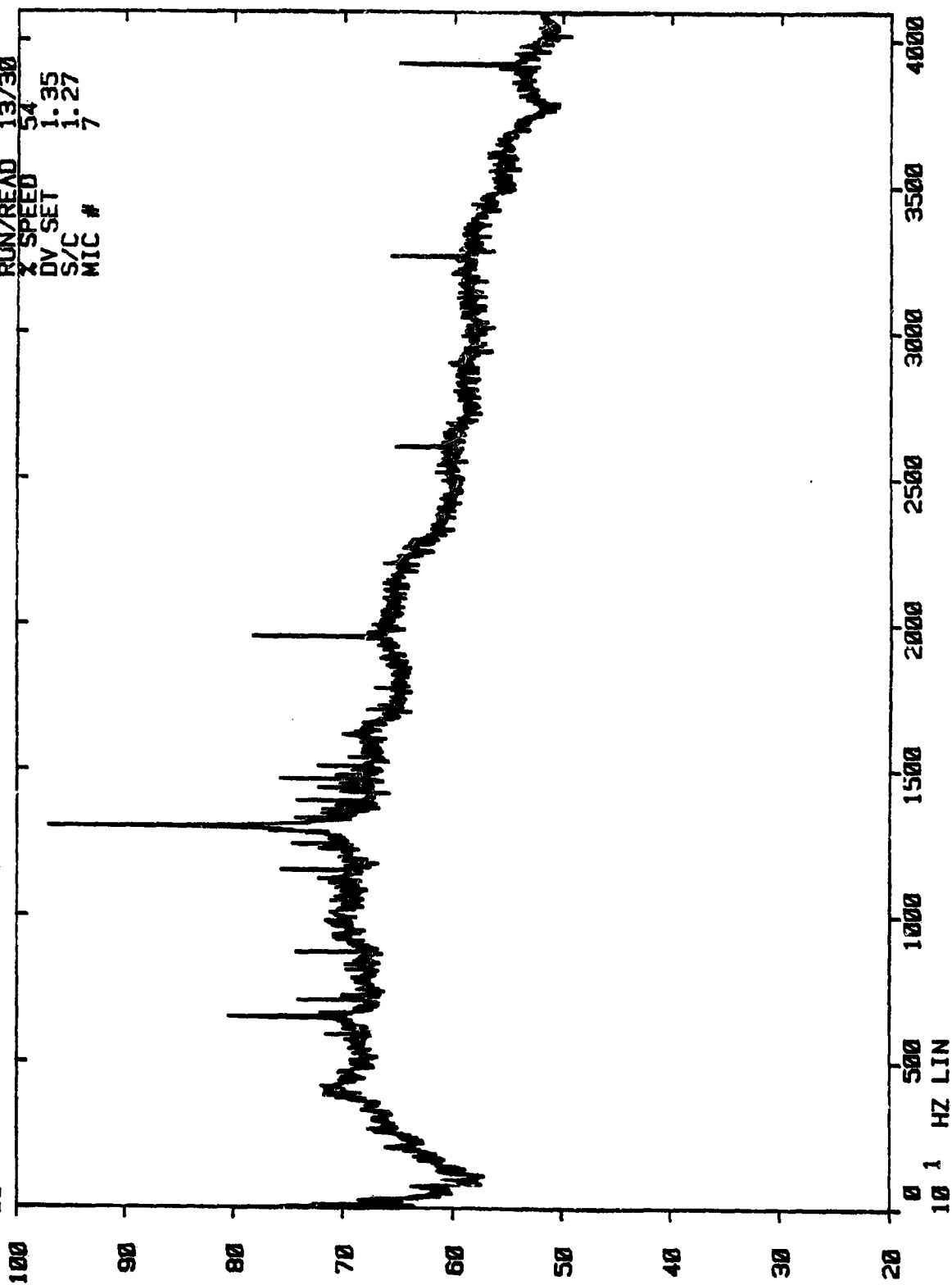
RUN/READ 13/30
X SPEED 54
DV SET 1.35
S/C 1.27
MIC # 6

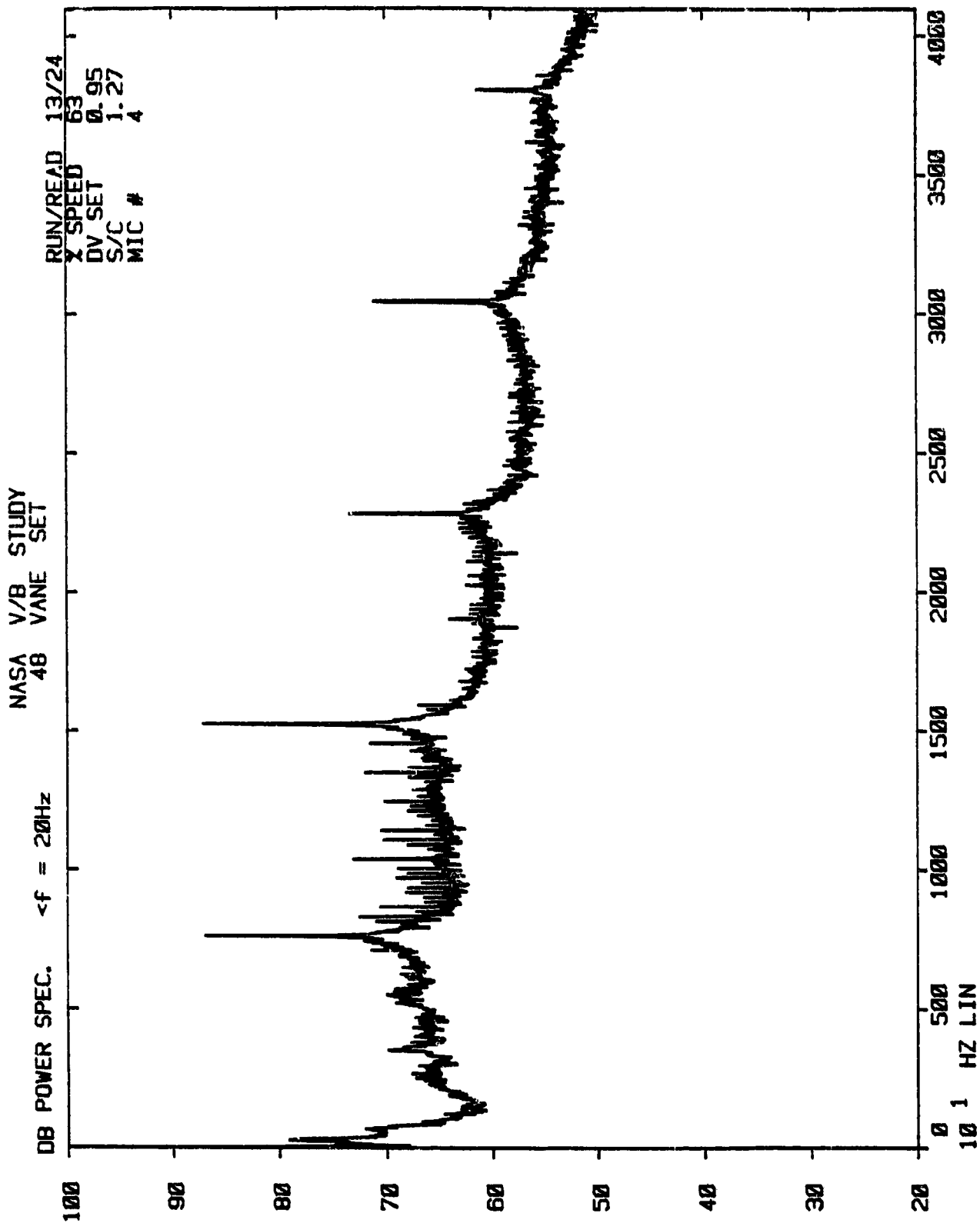


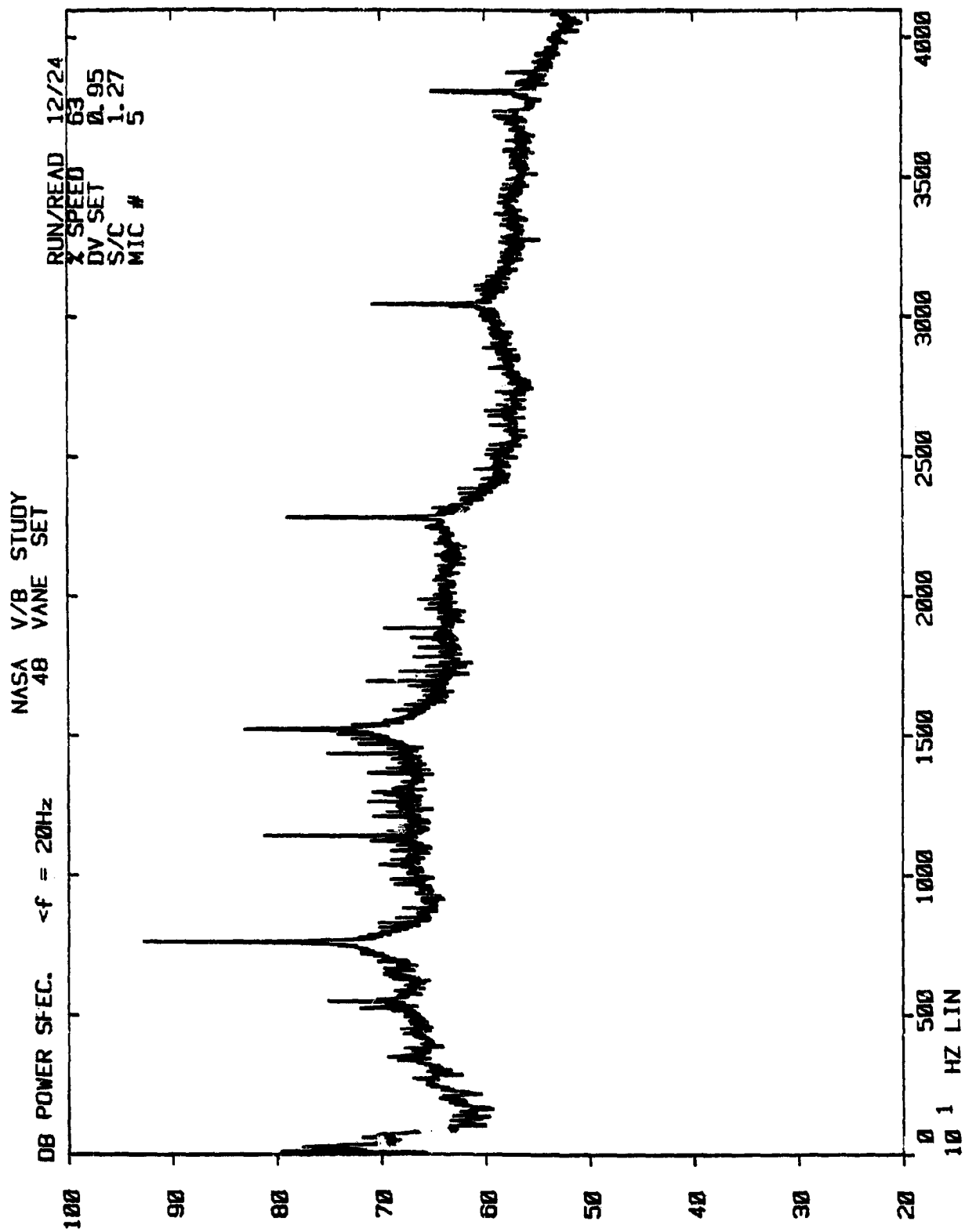
NASA V/B STUDY
48 VANE SET

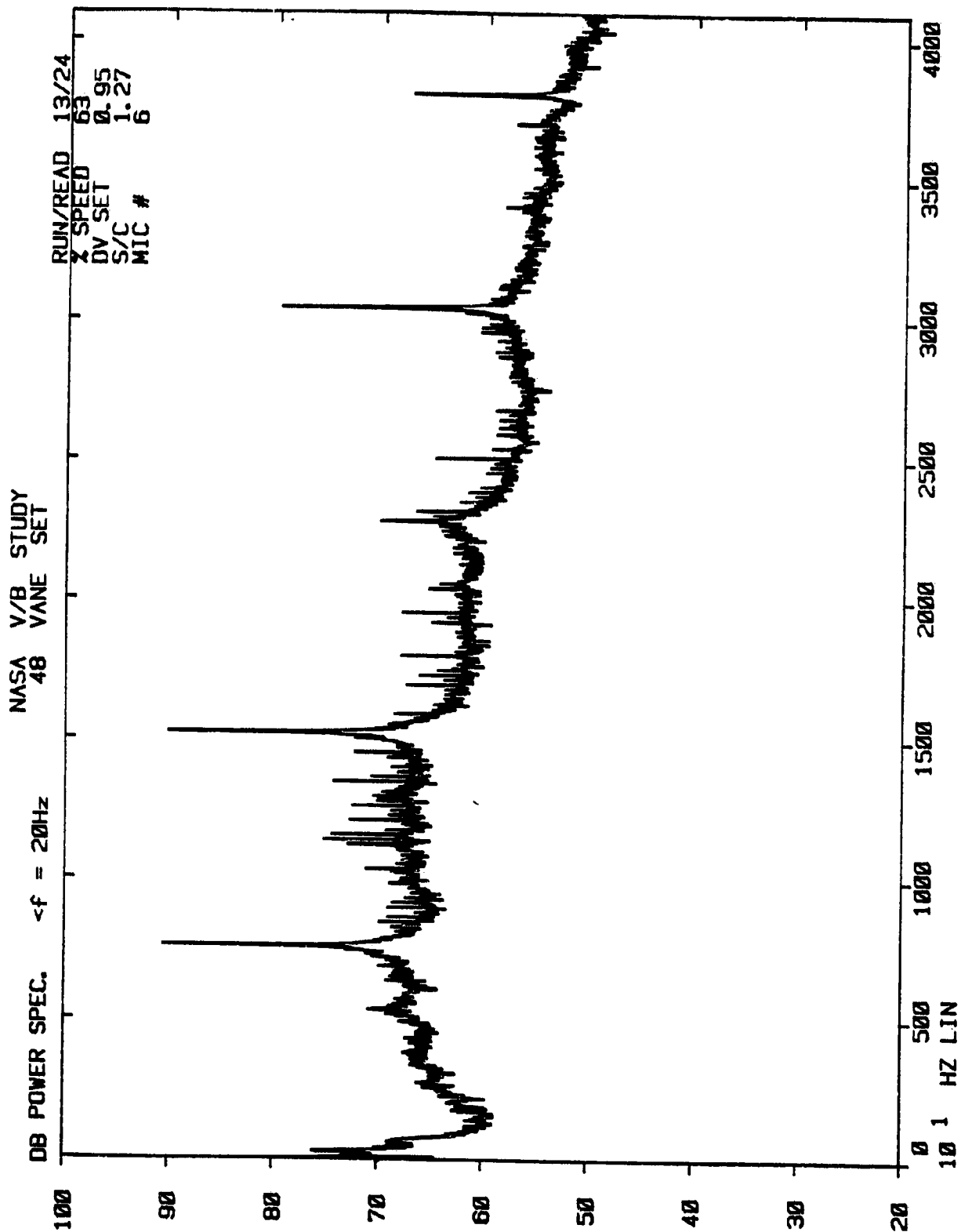
DB POWER SPEC. <f = 20Hz

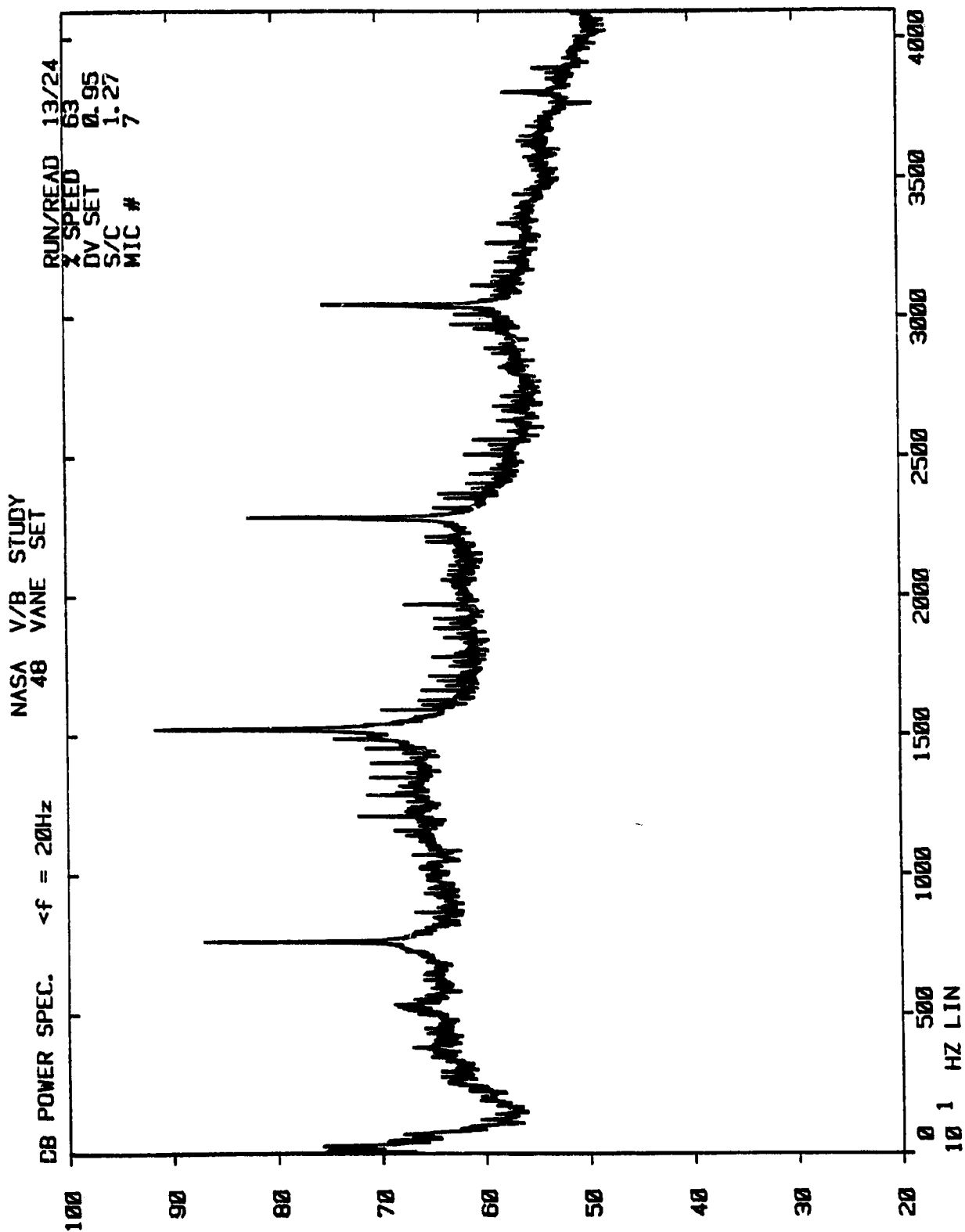
RUN/READ 13/30
X SPEED 54
DV SET 1.35
S/C 1.27
MIC # 7

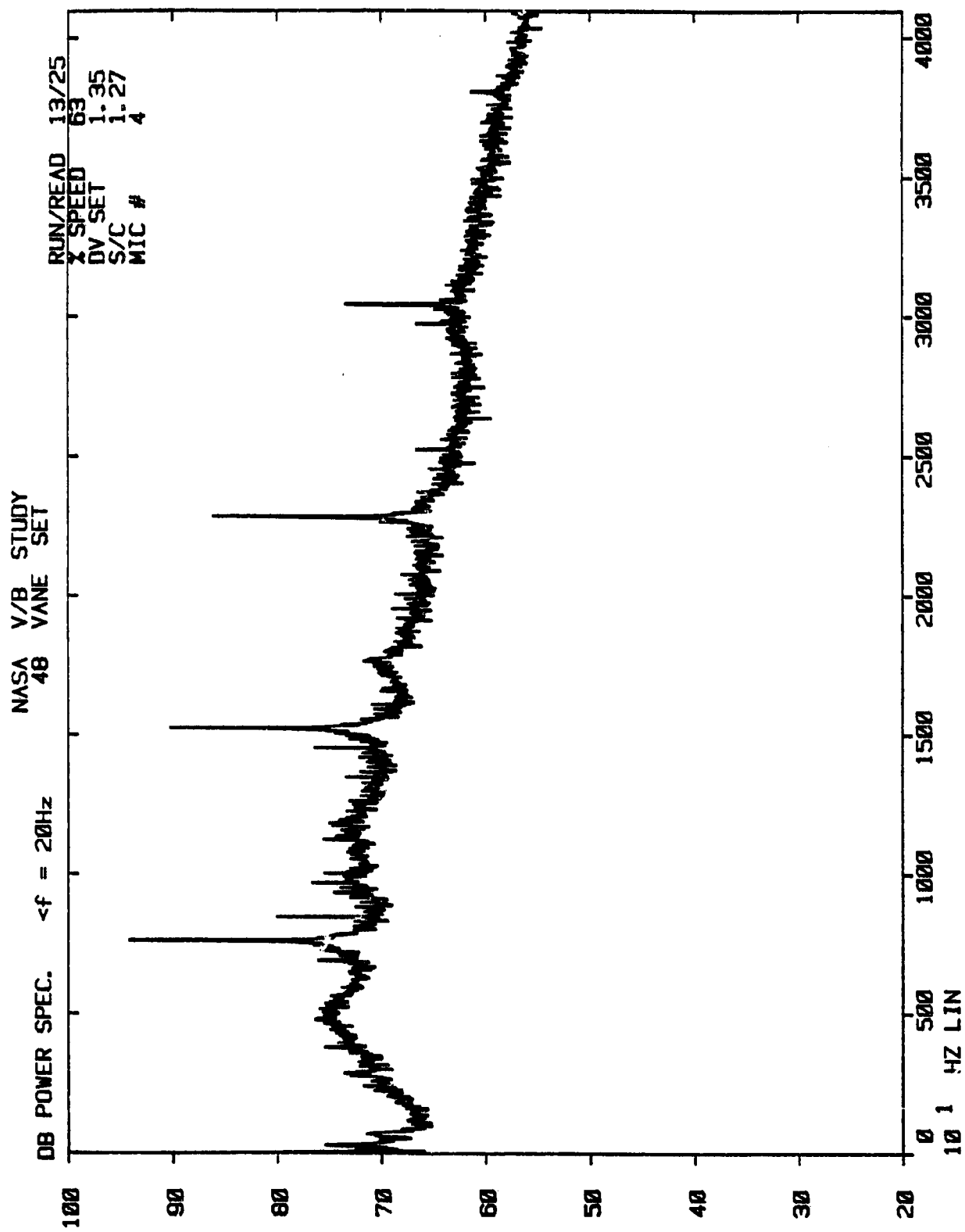


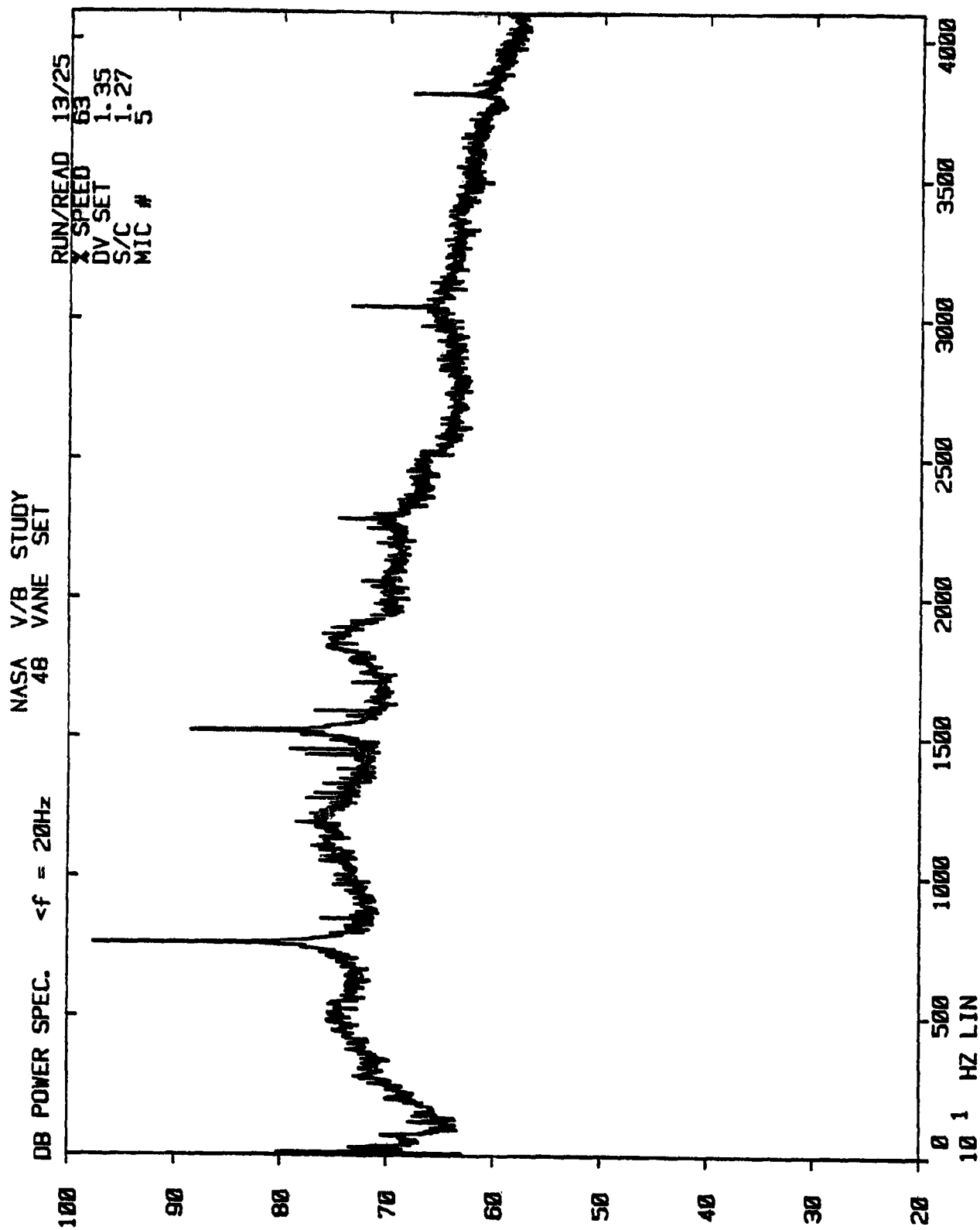


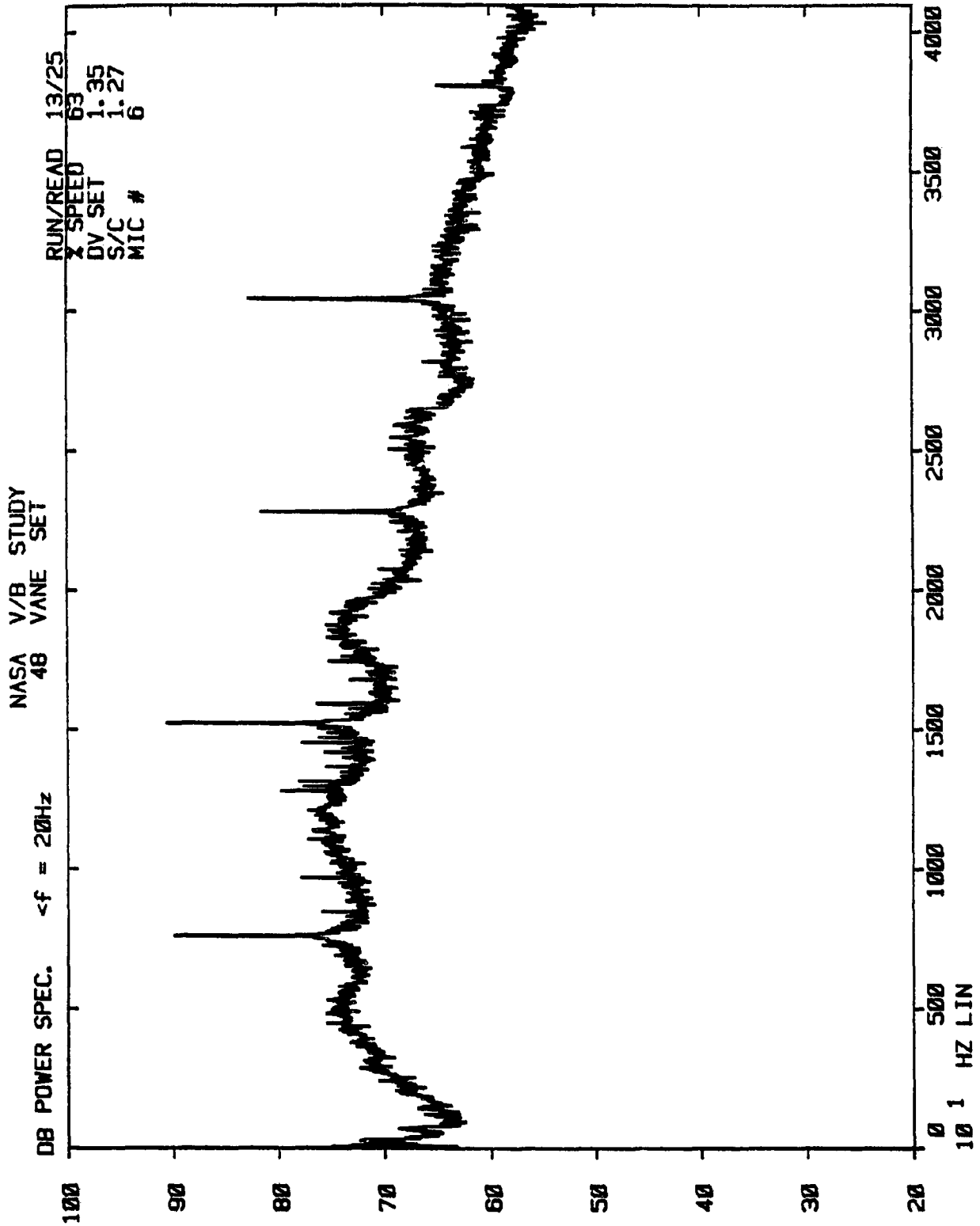


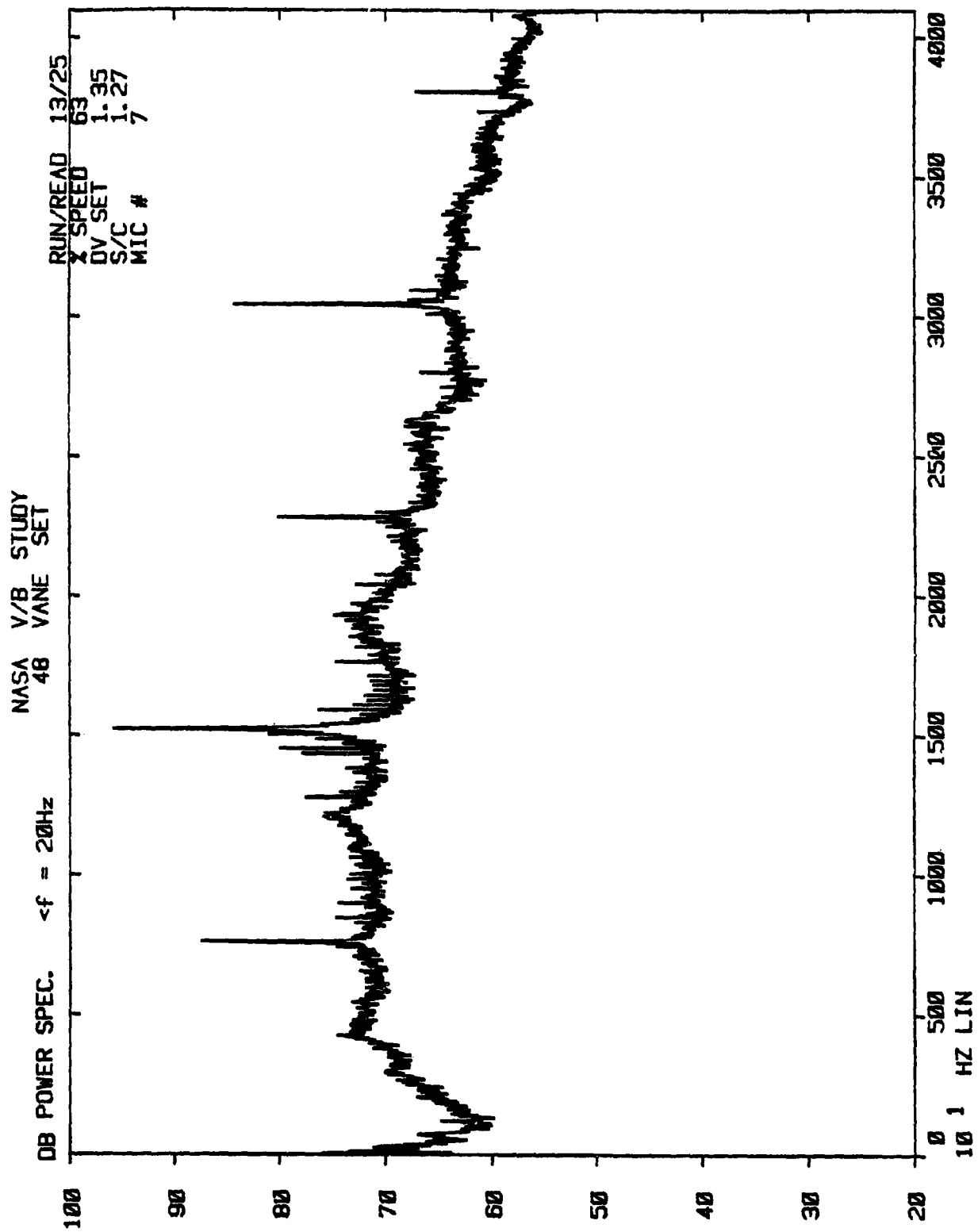


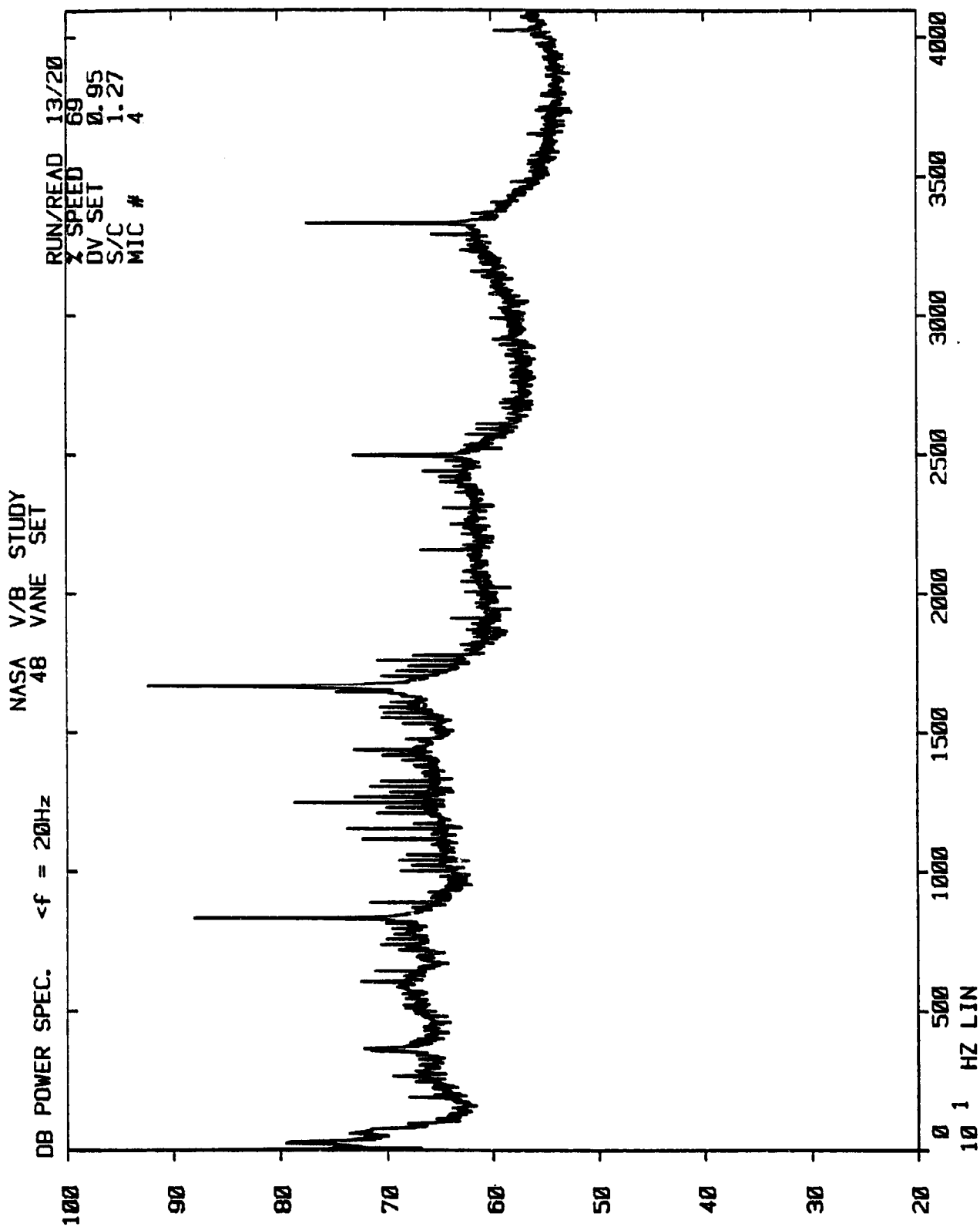


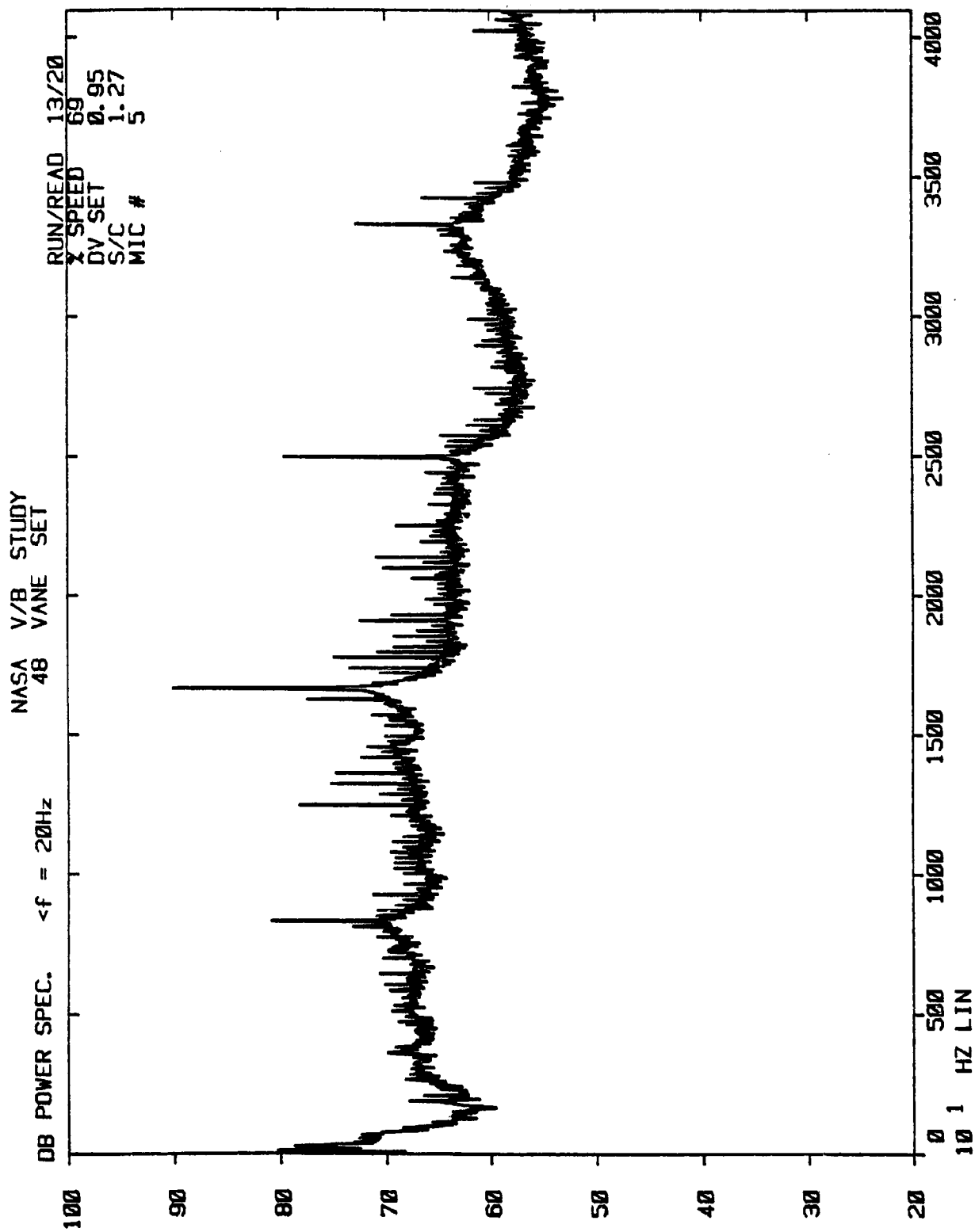


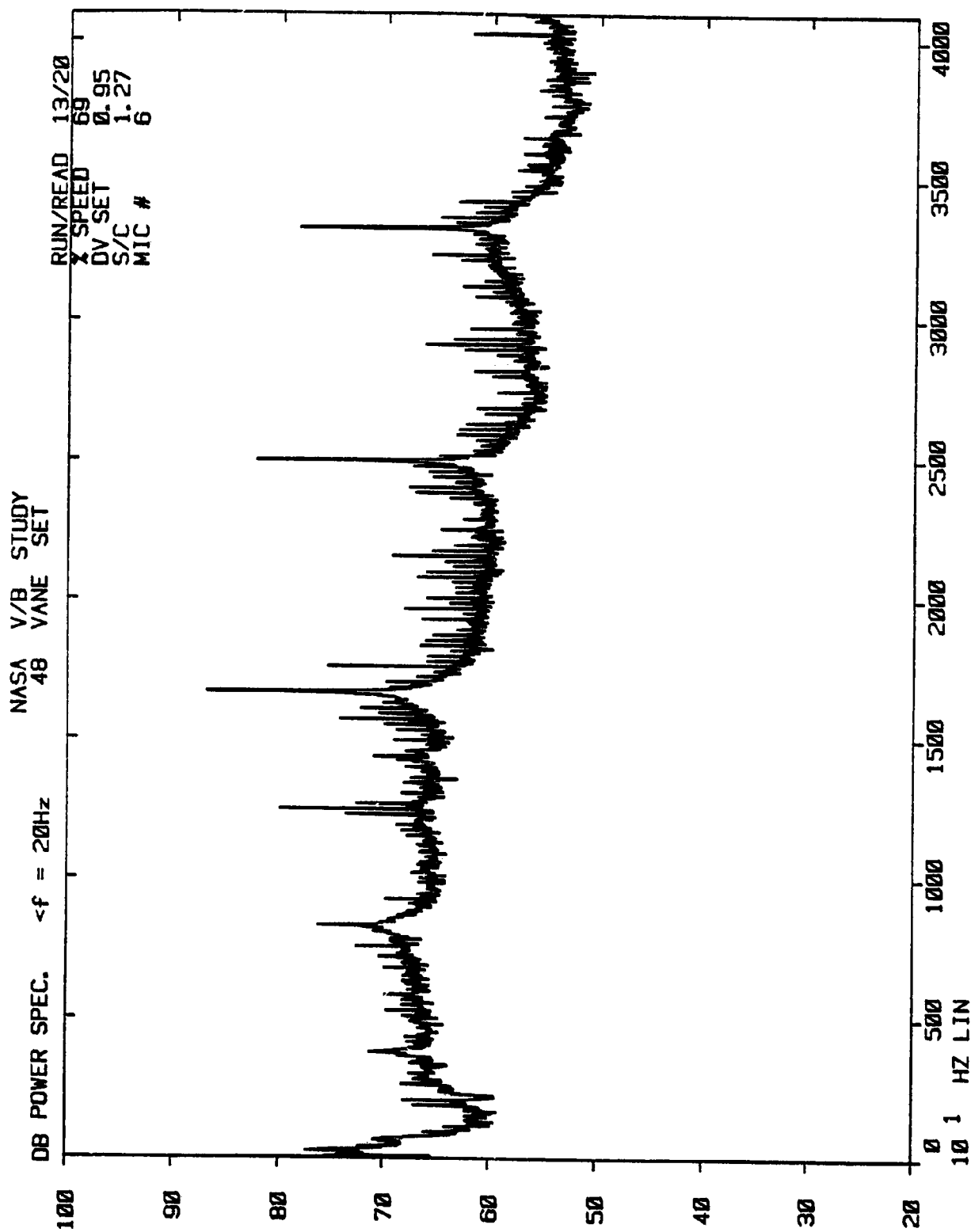












NASA V/B STUDY
48 VANE SET

<f = 20Hz

DB POWER SPEC.

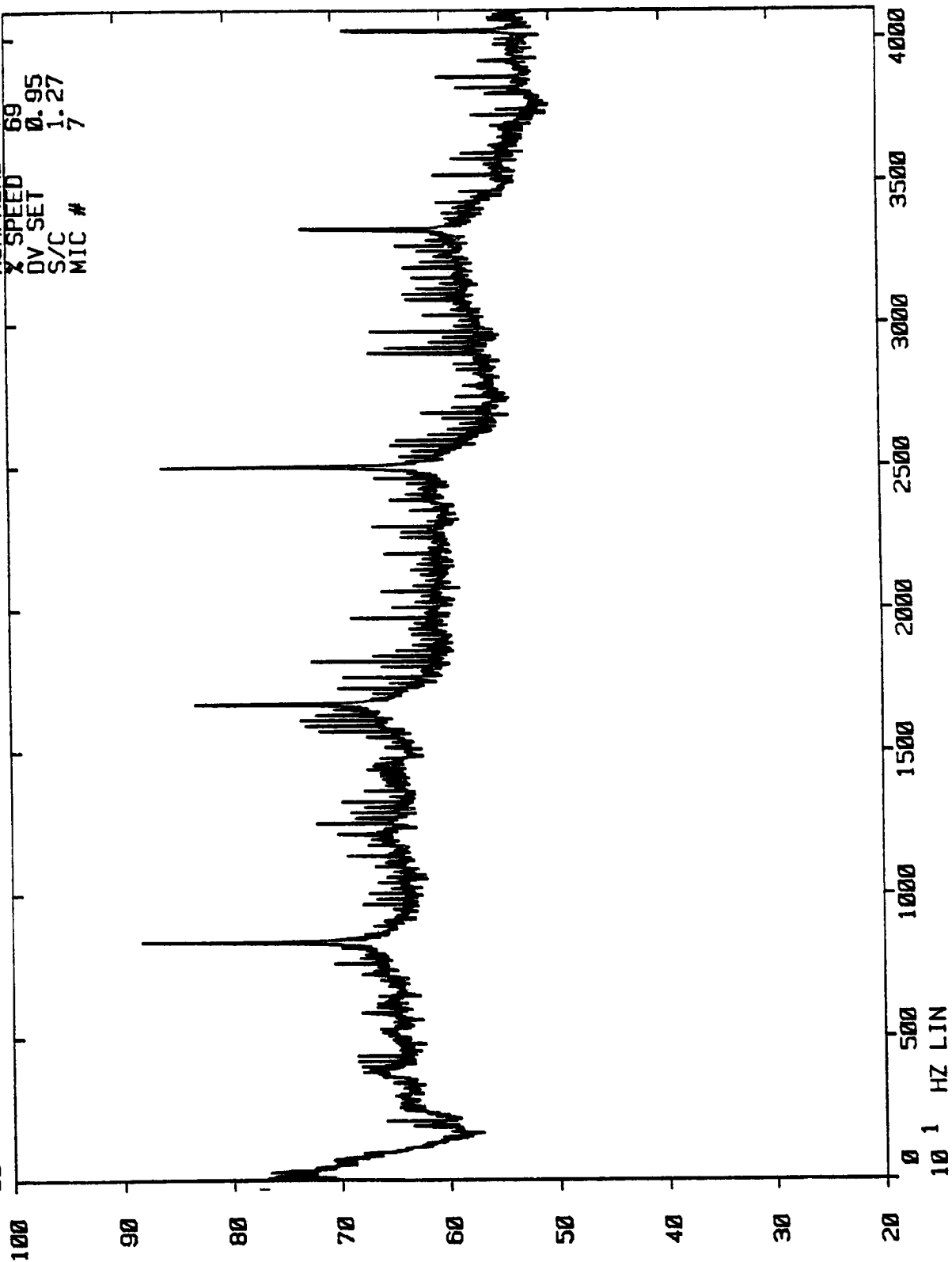
RUN/READ 13/20

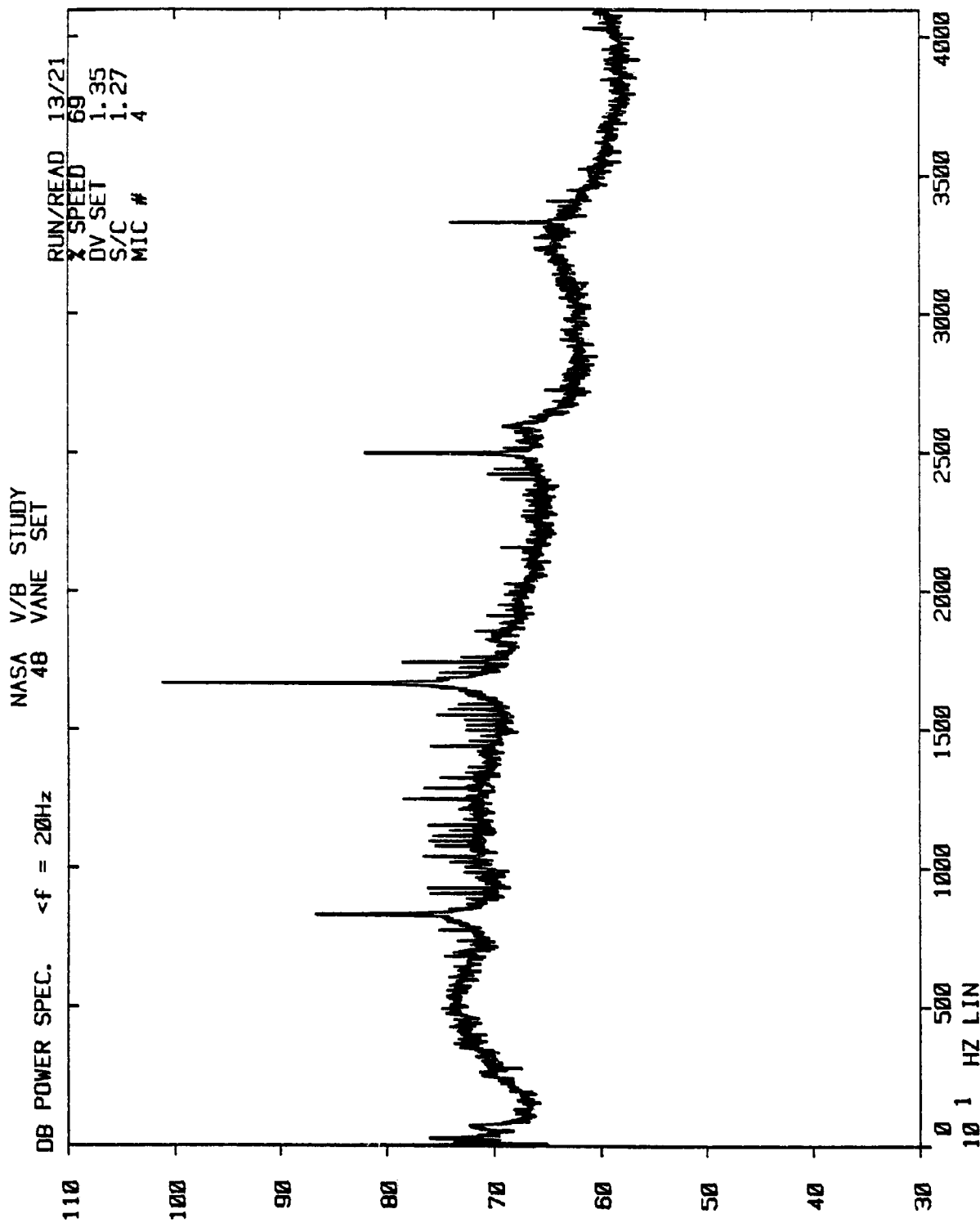
X SPEED 69

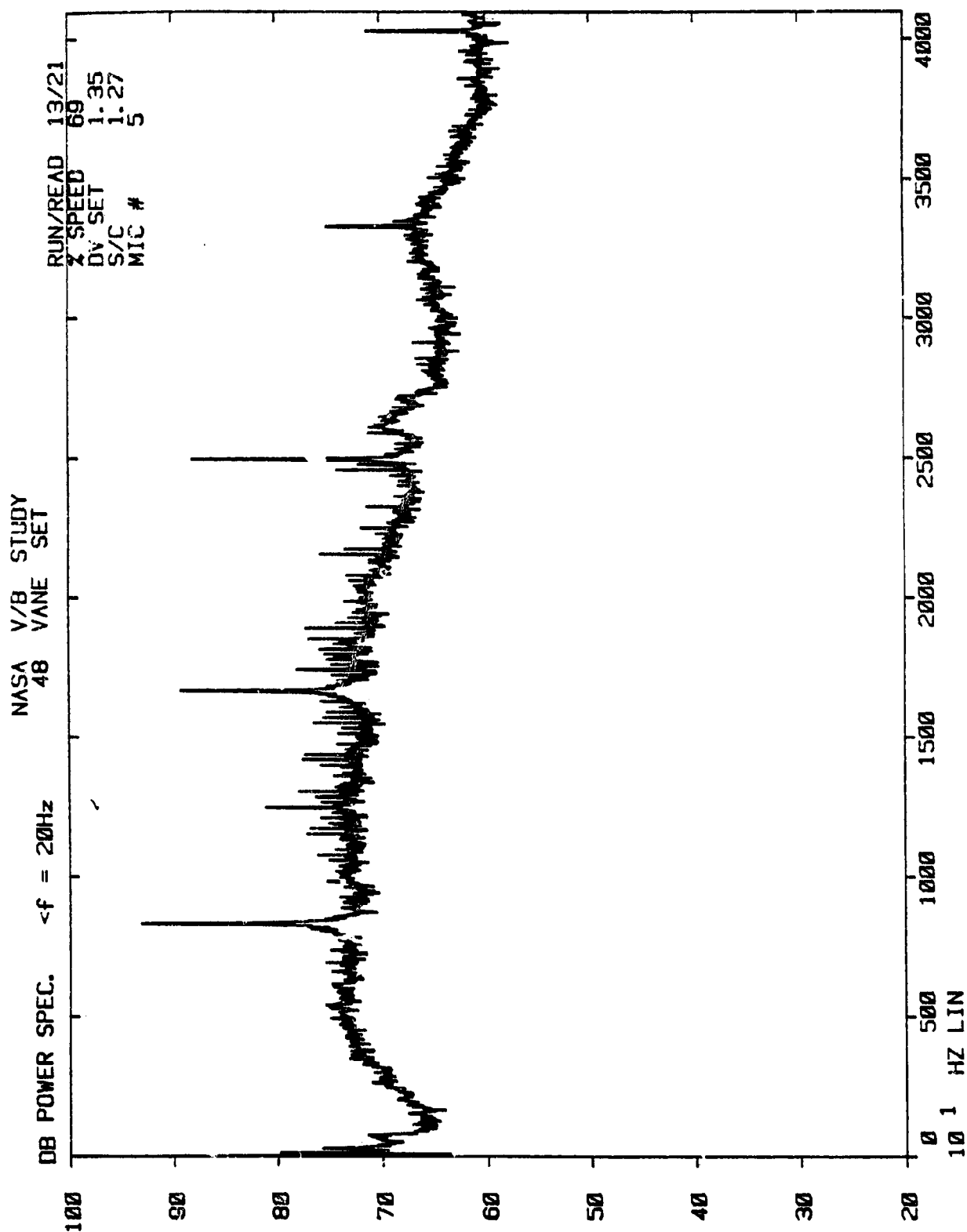
DV SET 0.95

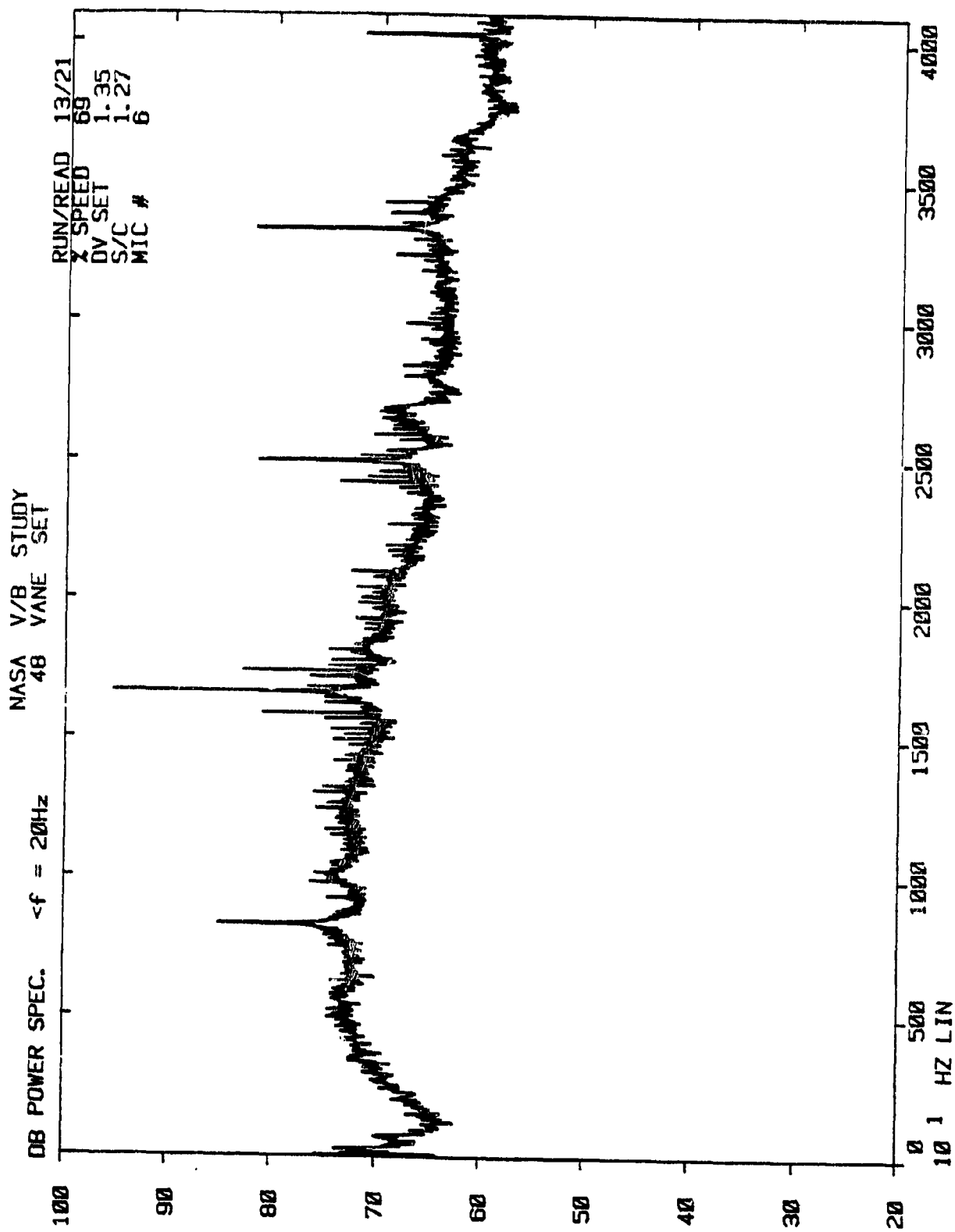
S/C 1.27

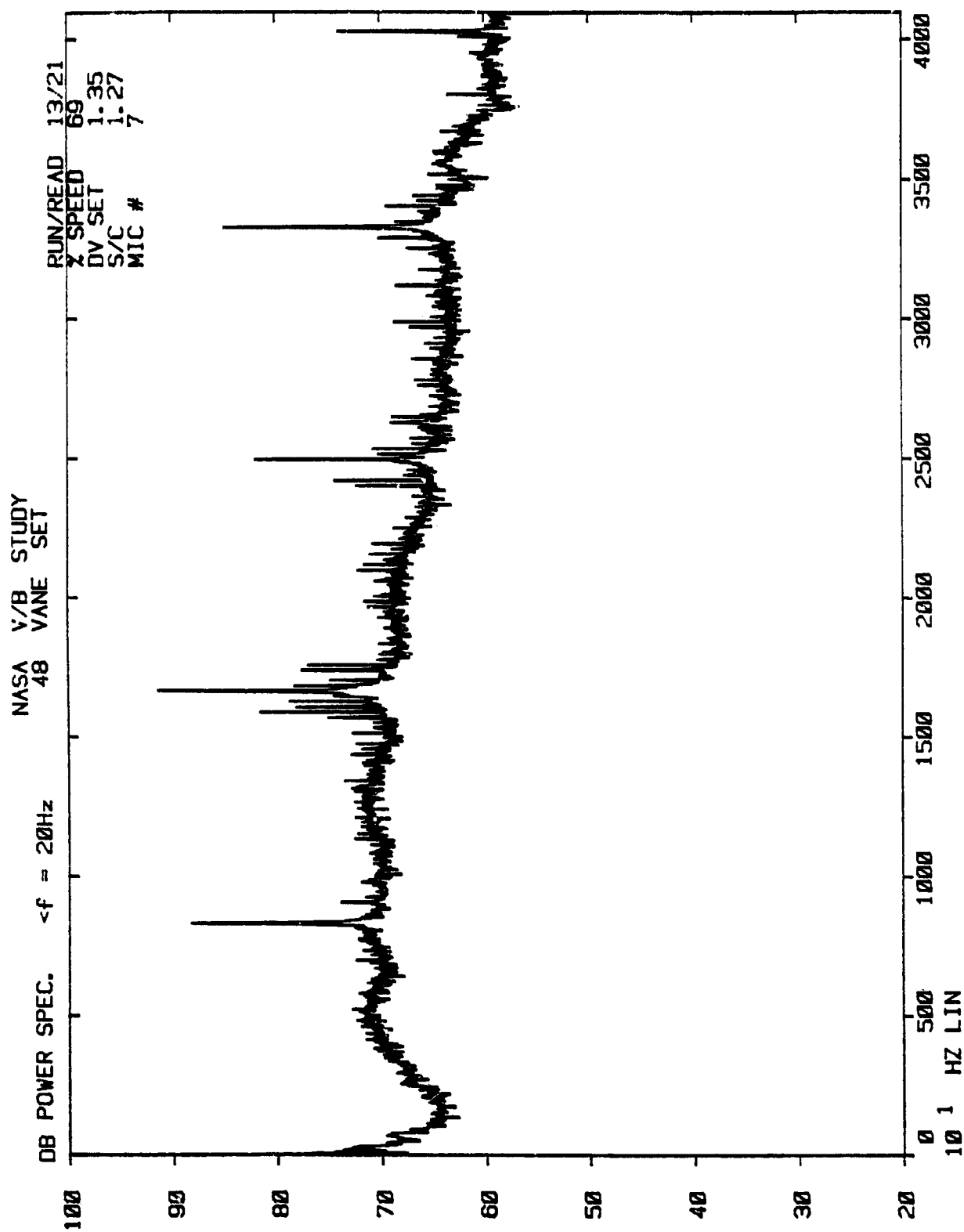
MIC # 7

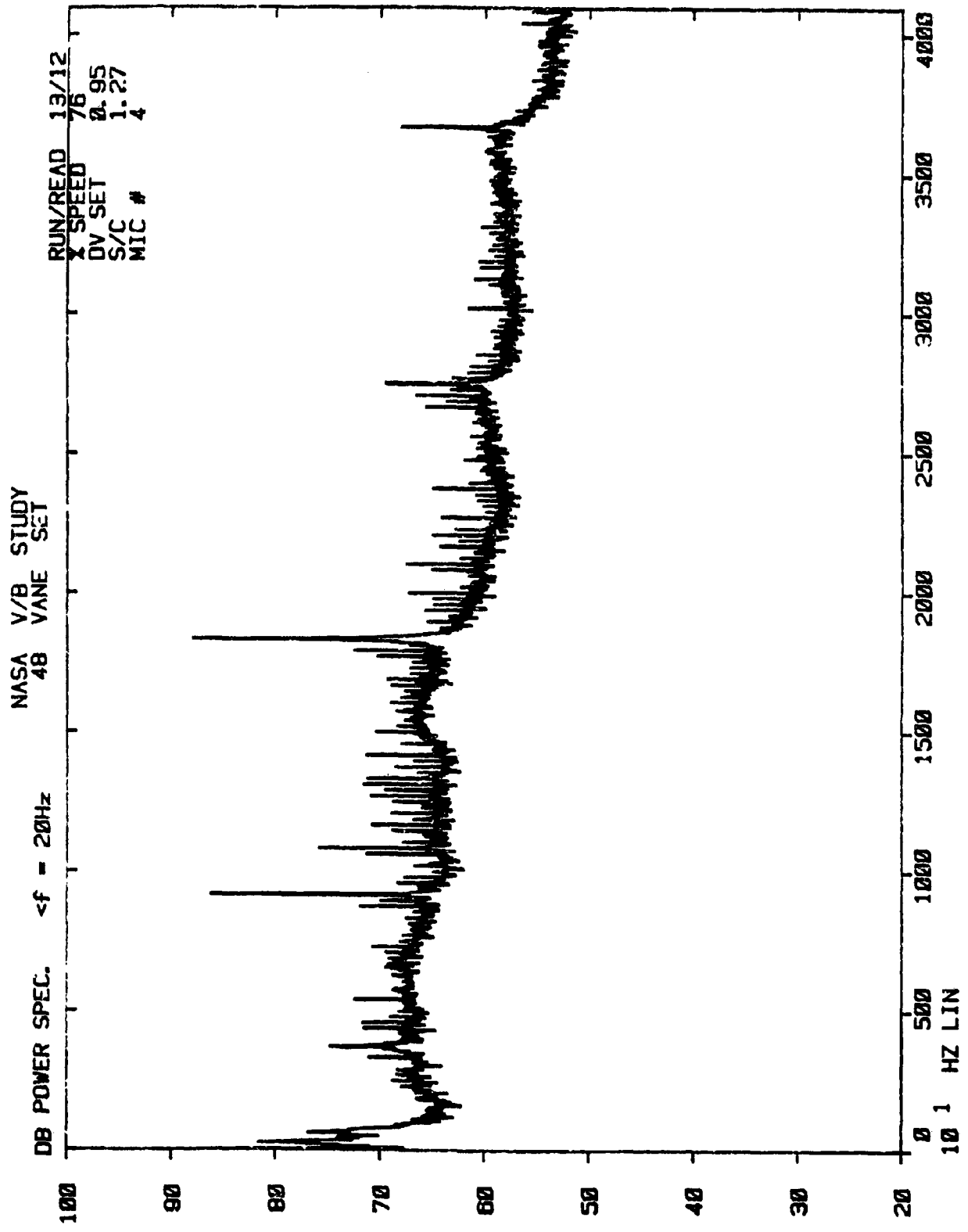








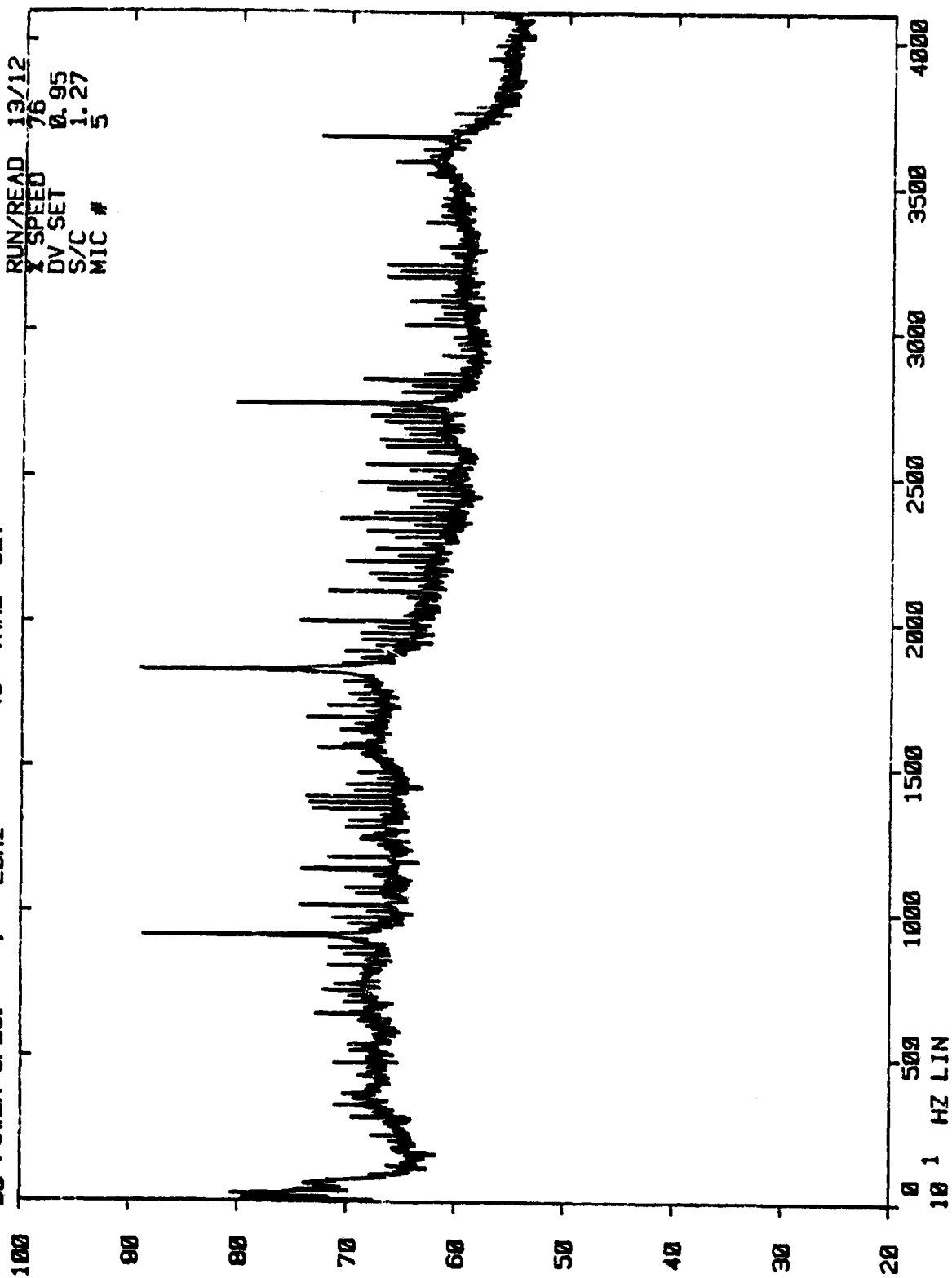


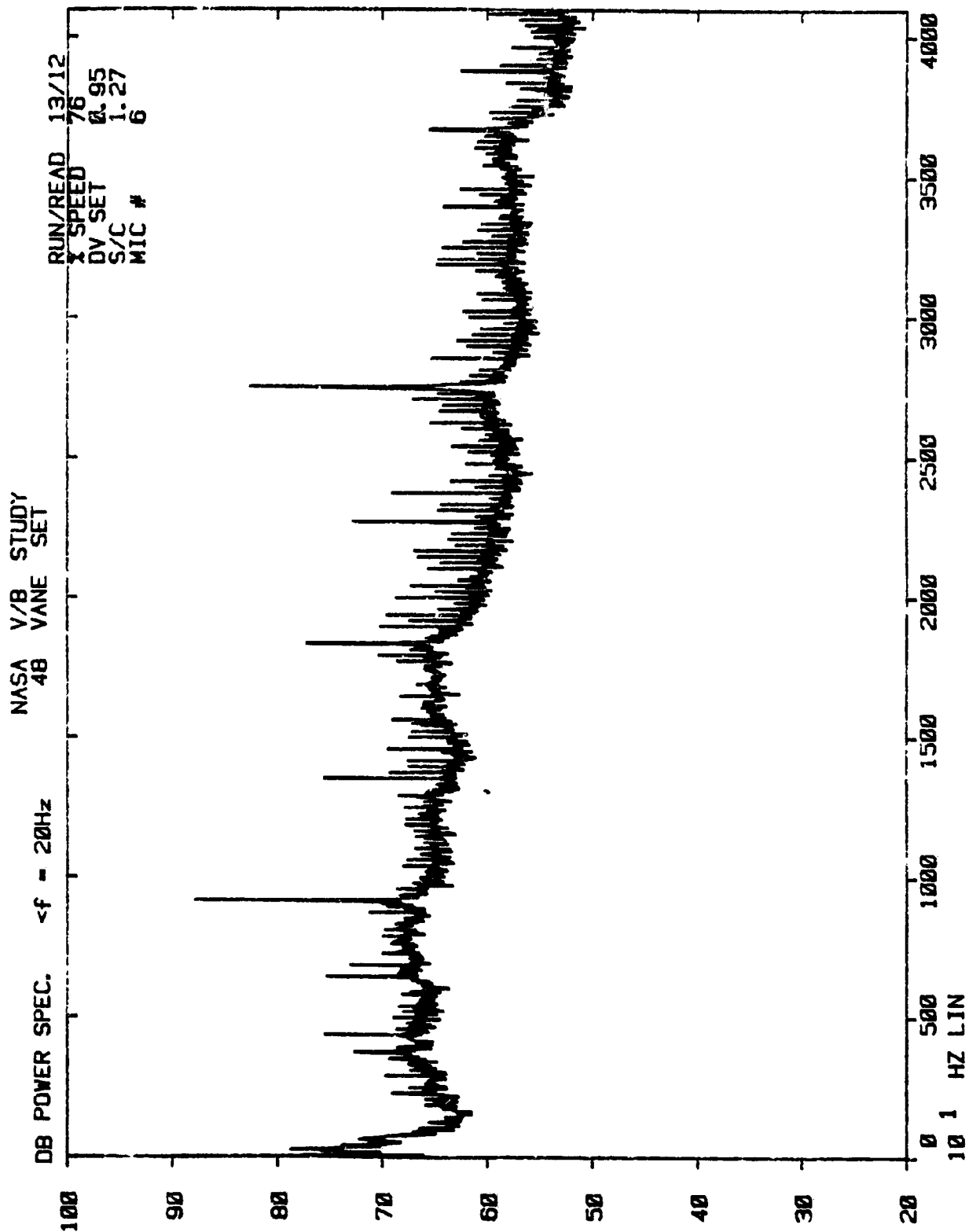


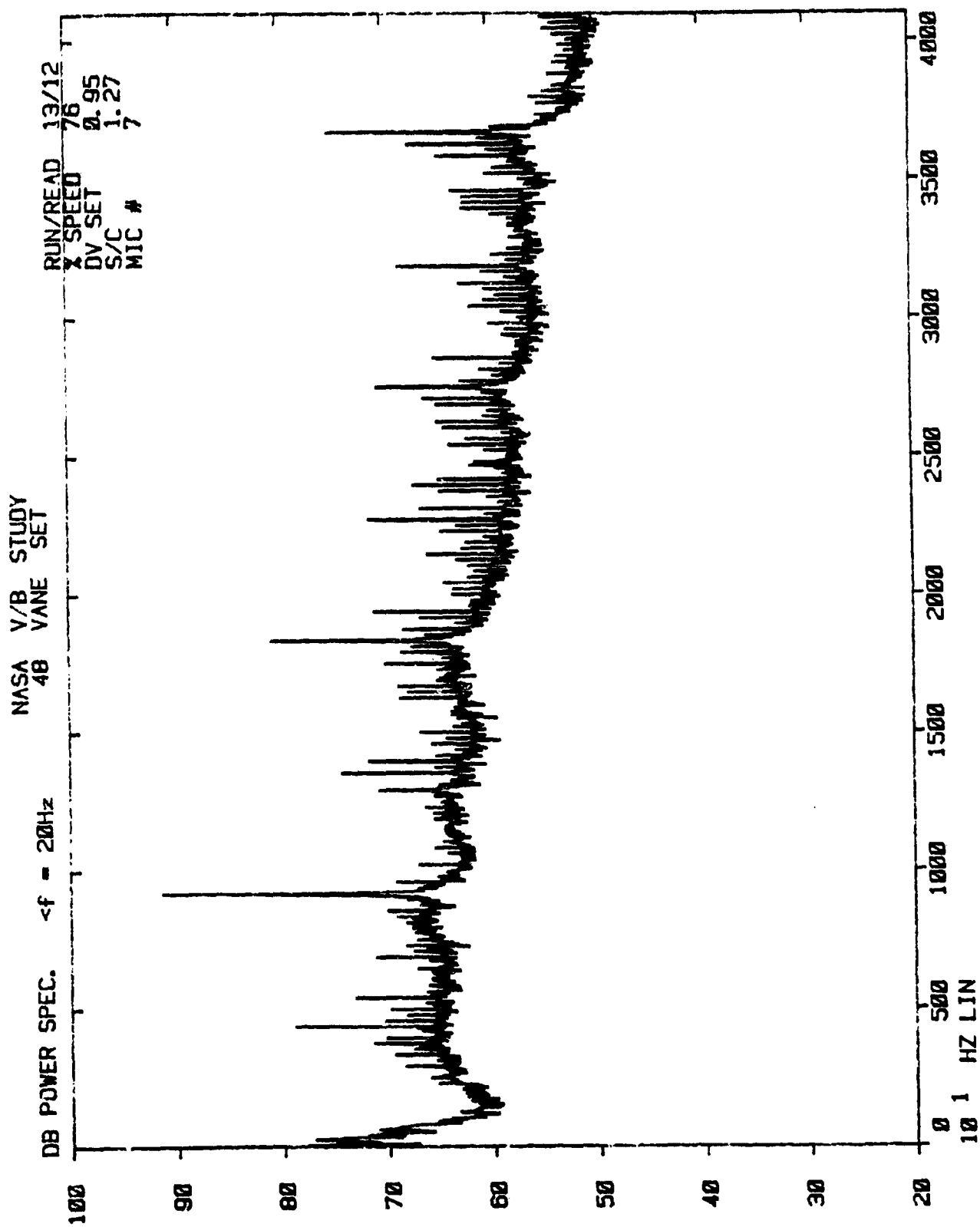
NASA V/B STUDY
48 VANE SET

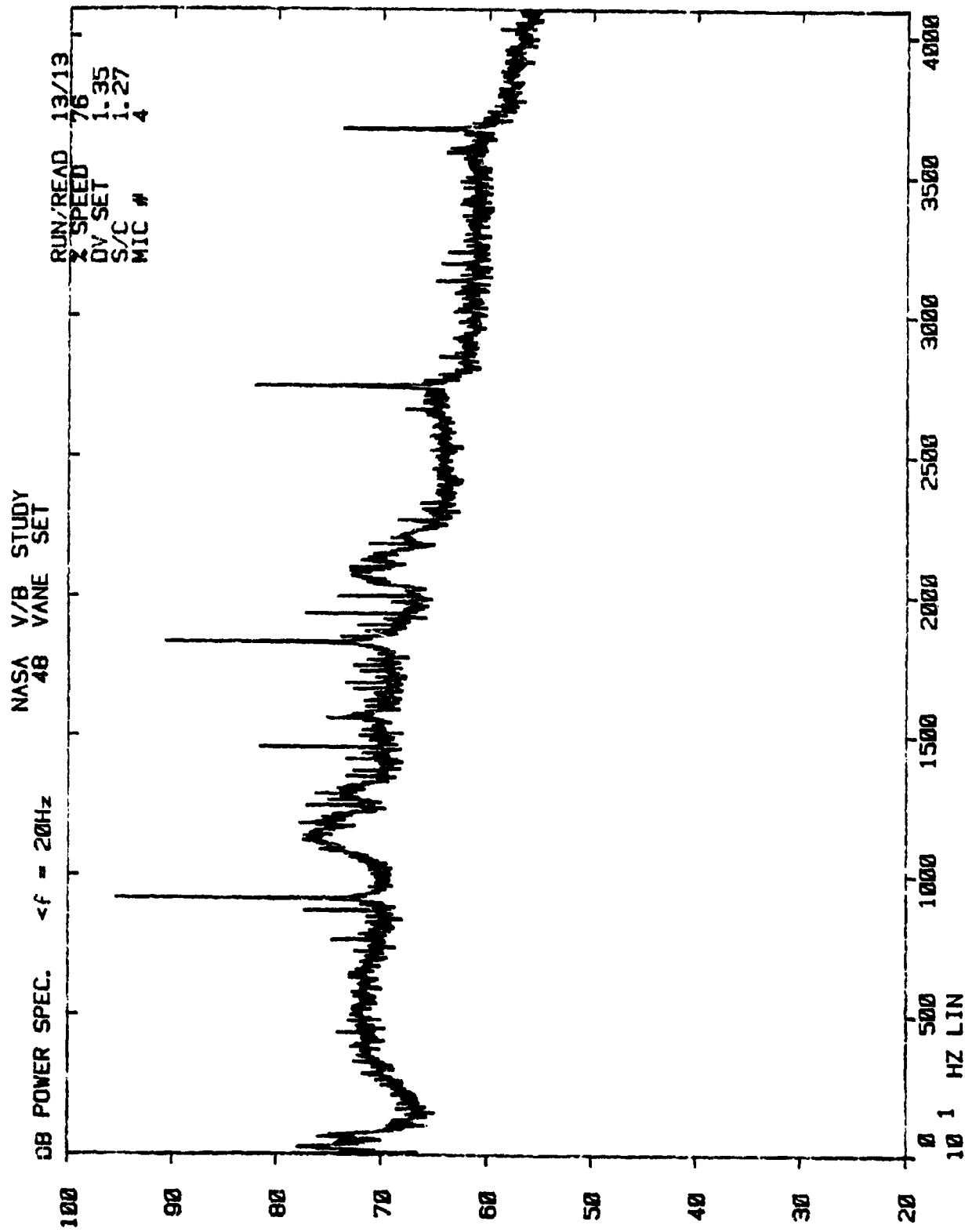
<f = 20Hz

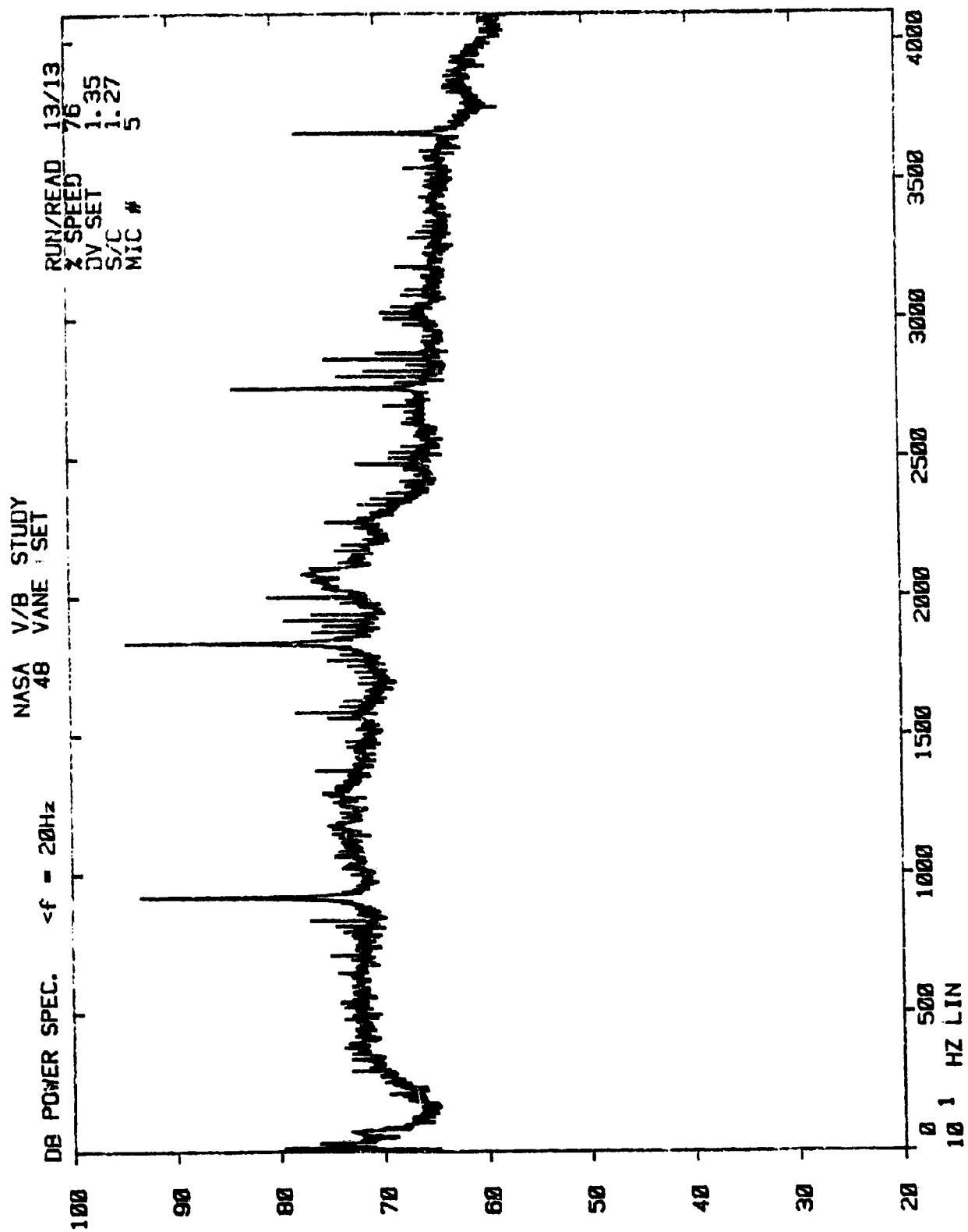
DB POWER SPEC.









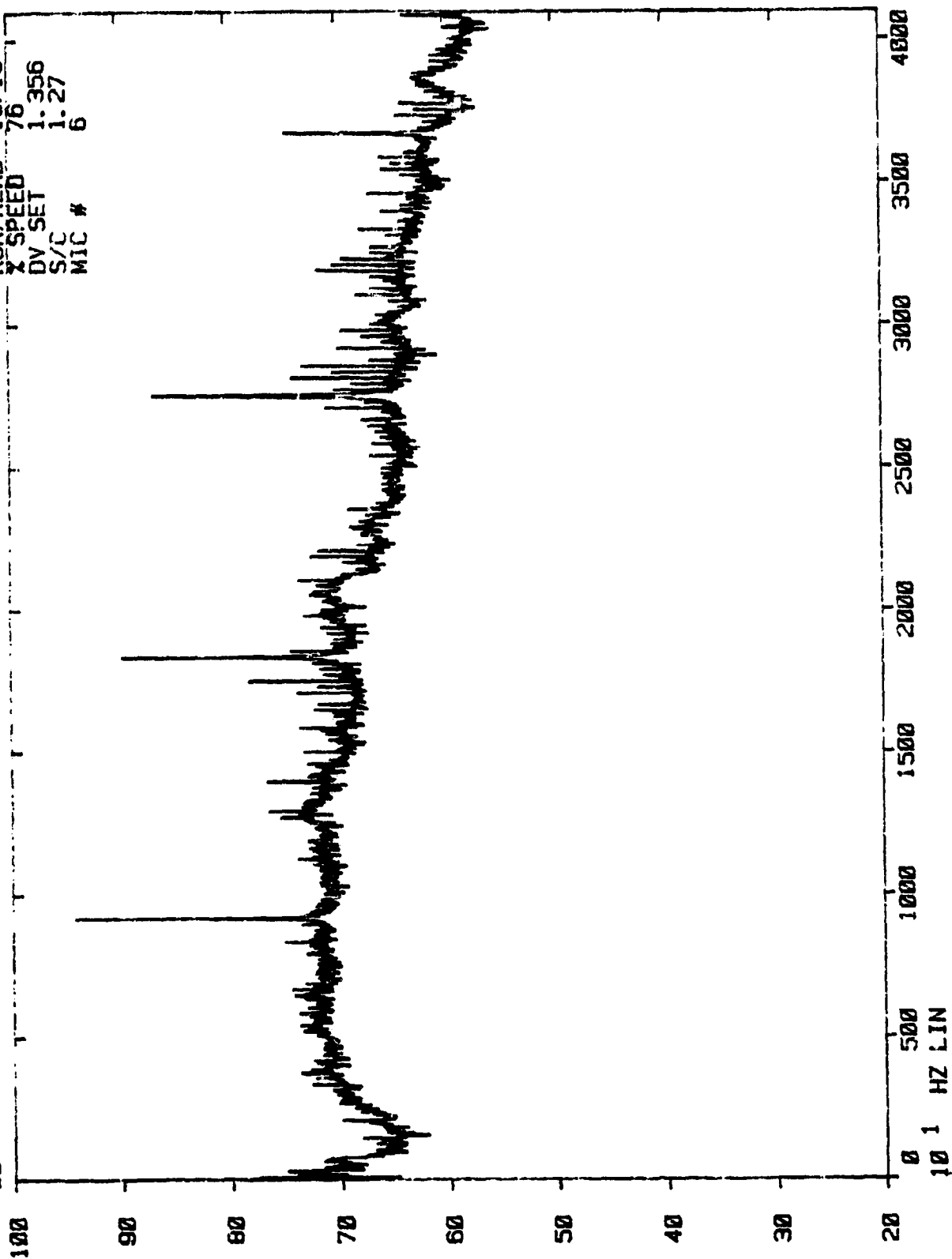


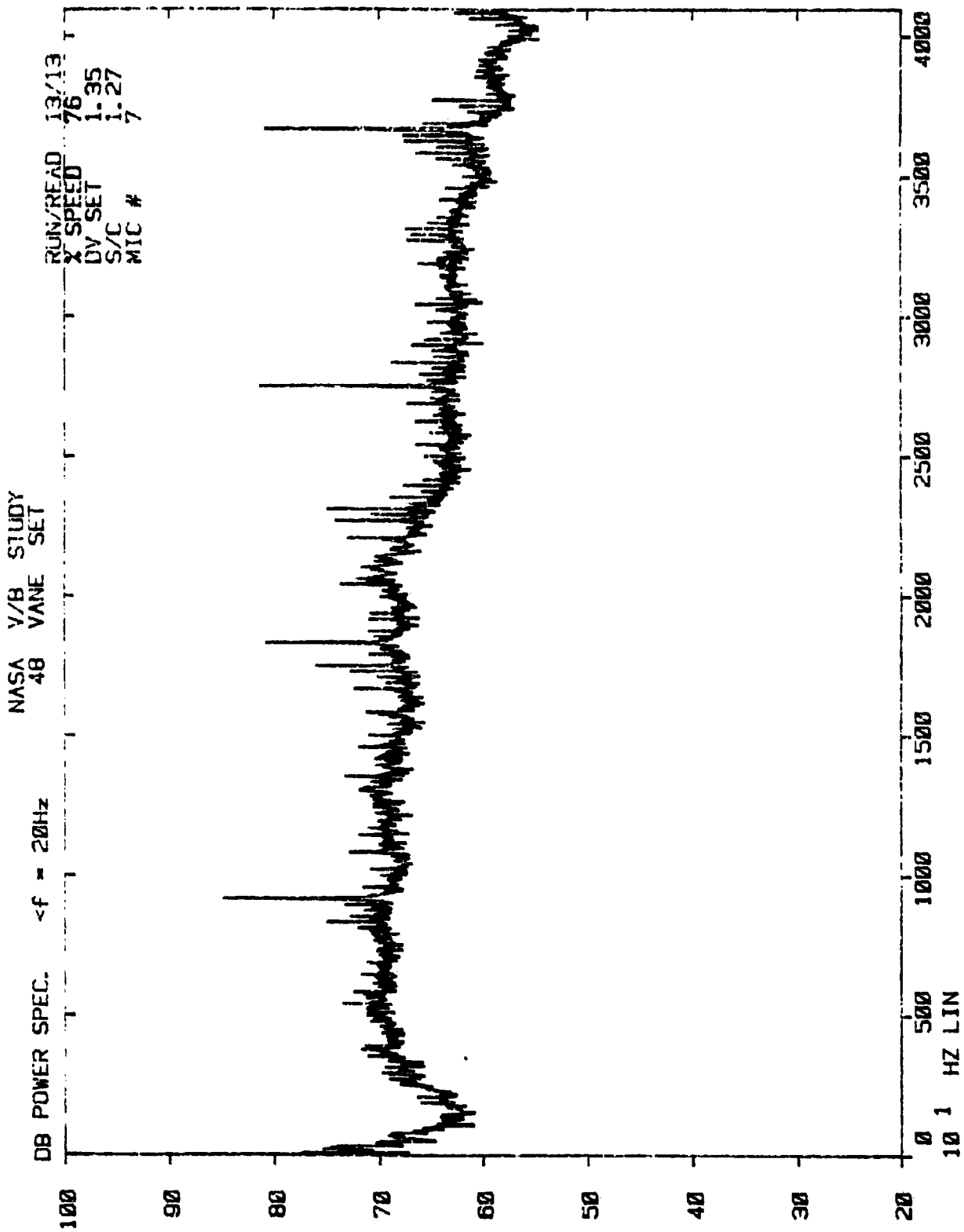
NASA V/B STUDY
48 VANE SET

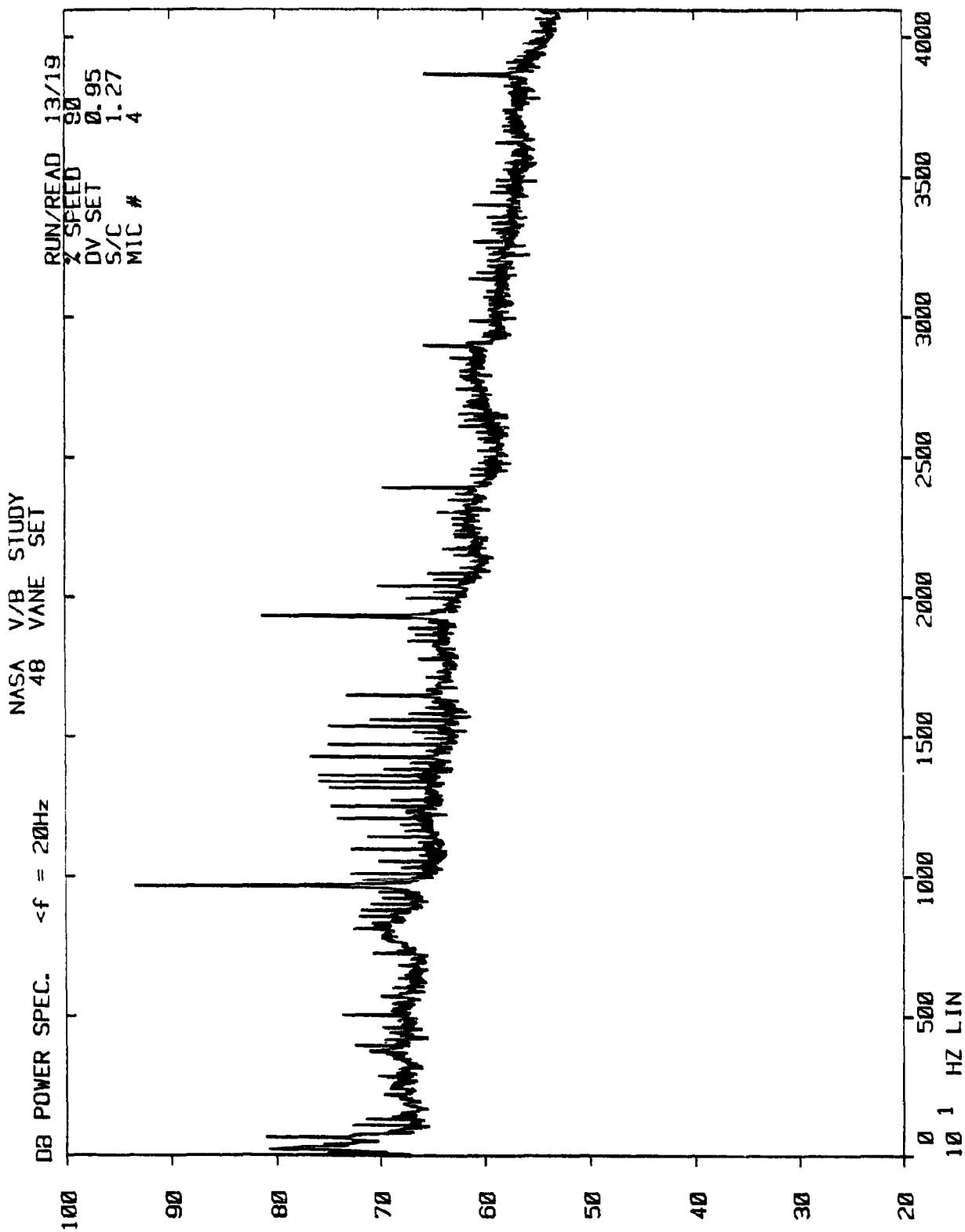
<f = 20Hz

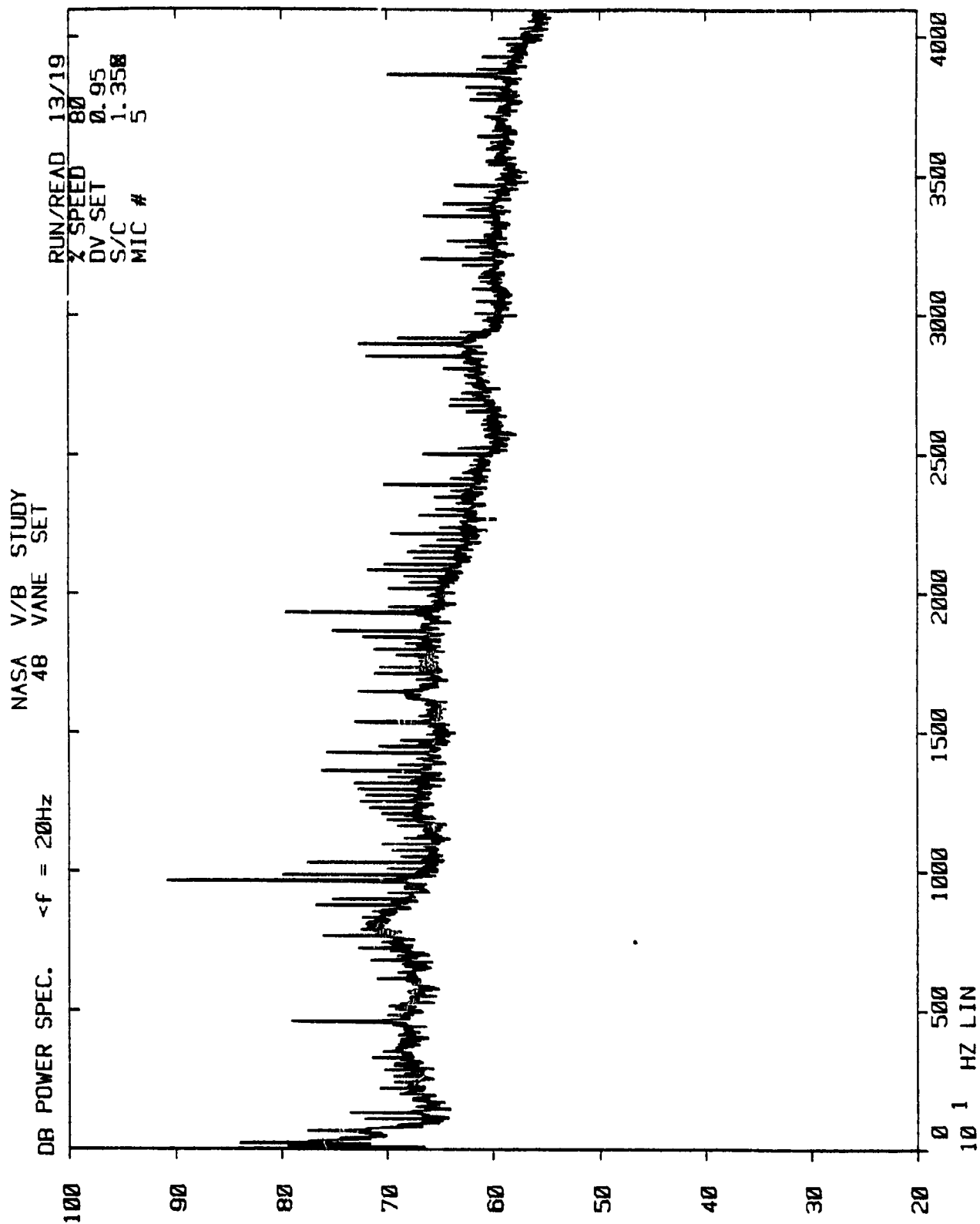
DB POWER SPEC.

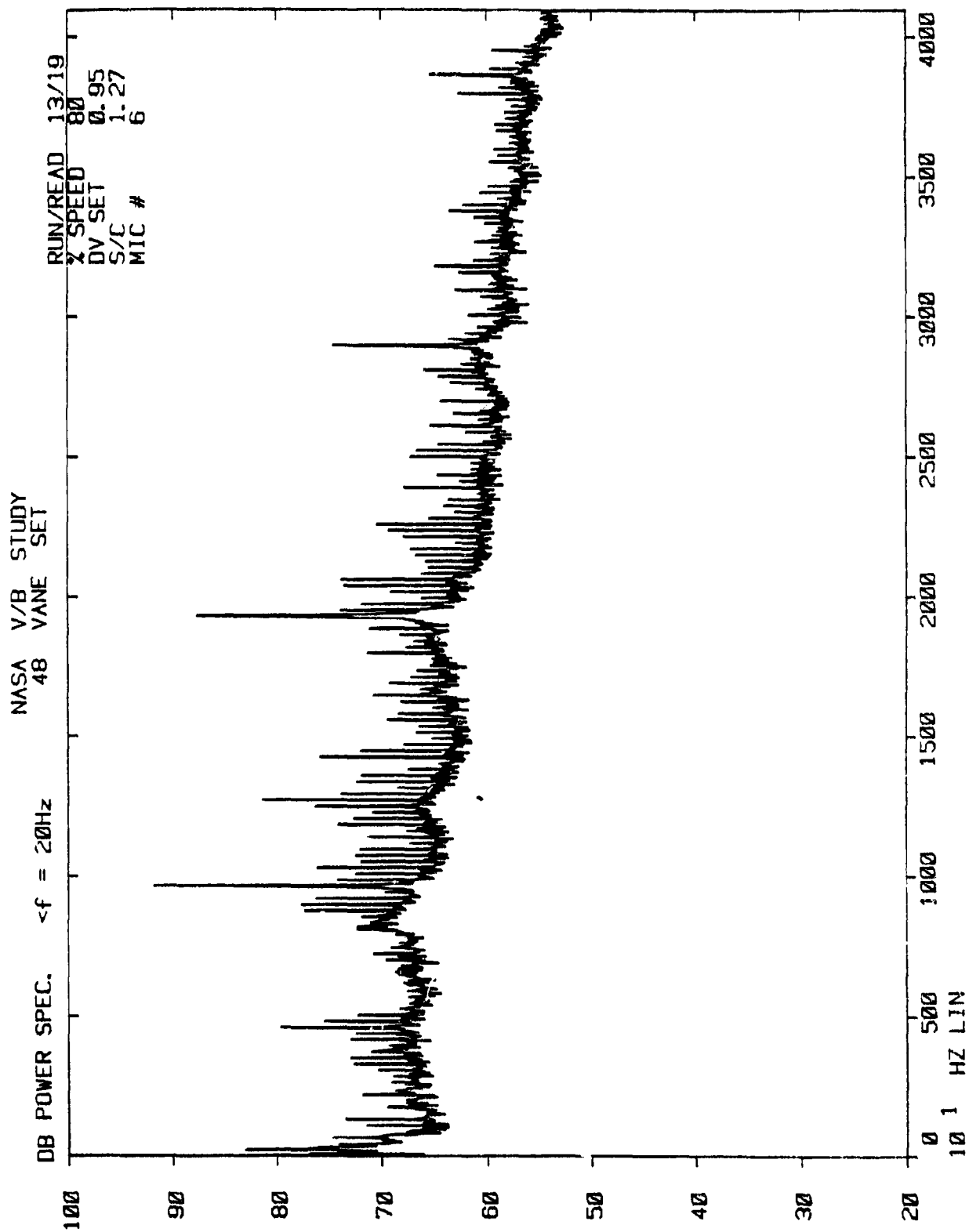
RUN/READ 13/13
X SPEED 76
DV SET 1.356
S/C 1.27
MIC # 6

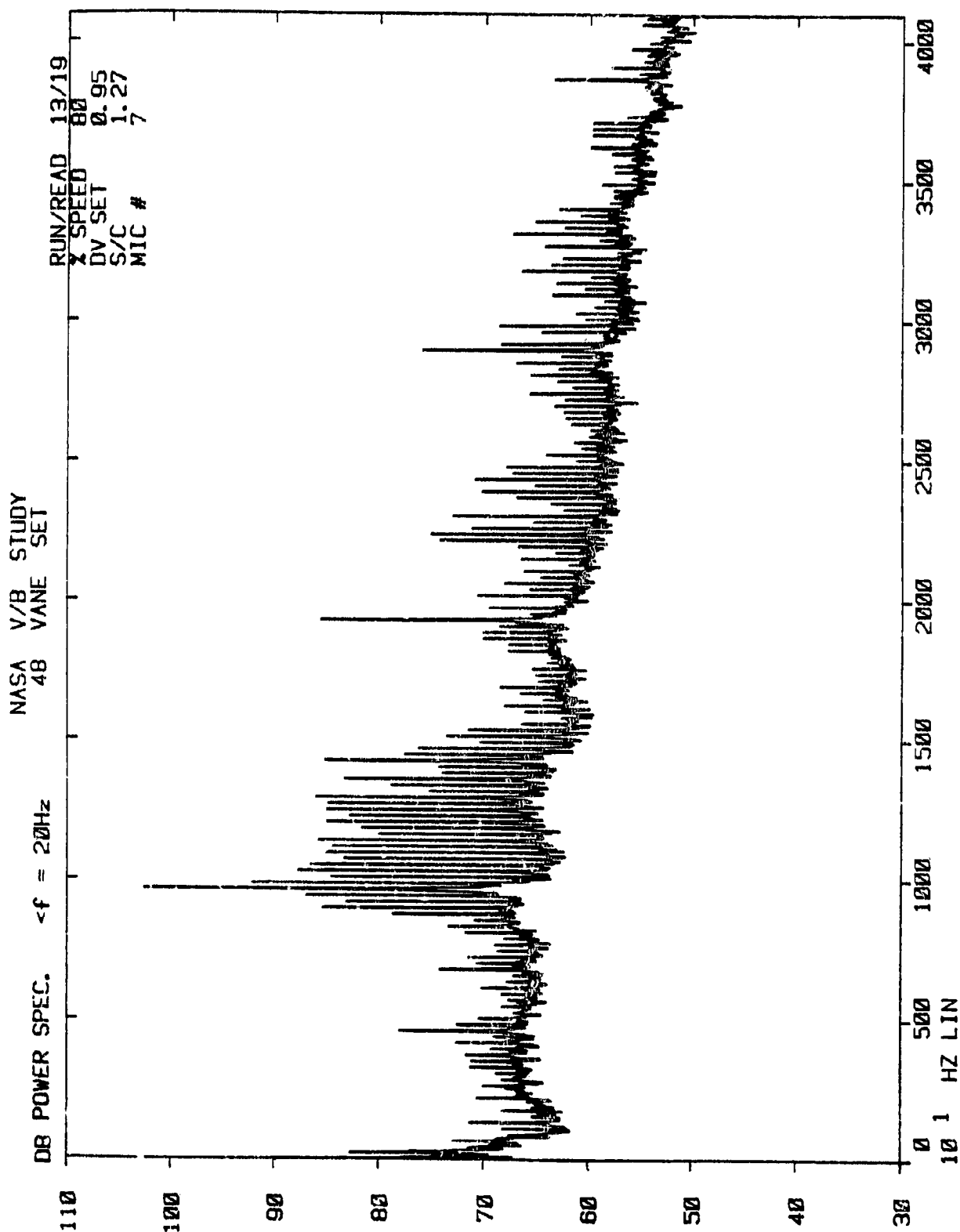


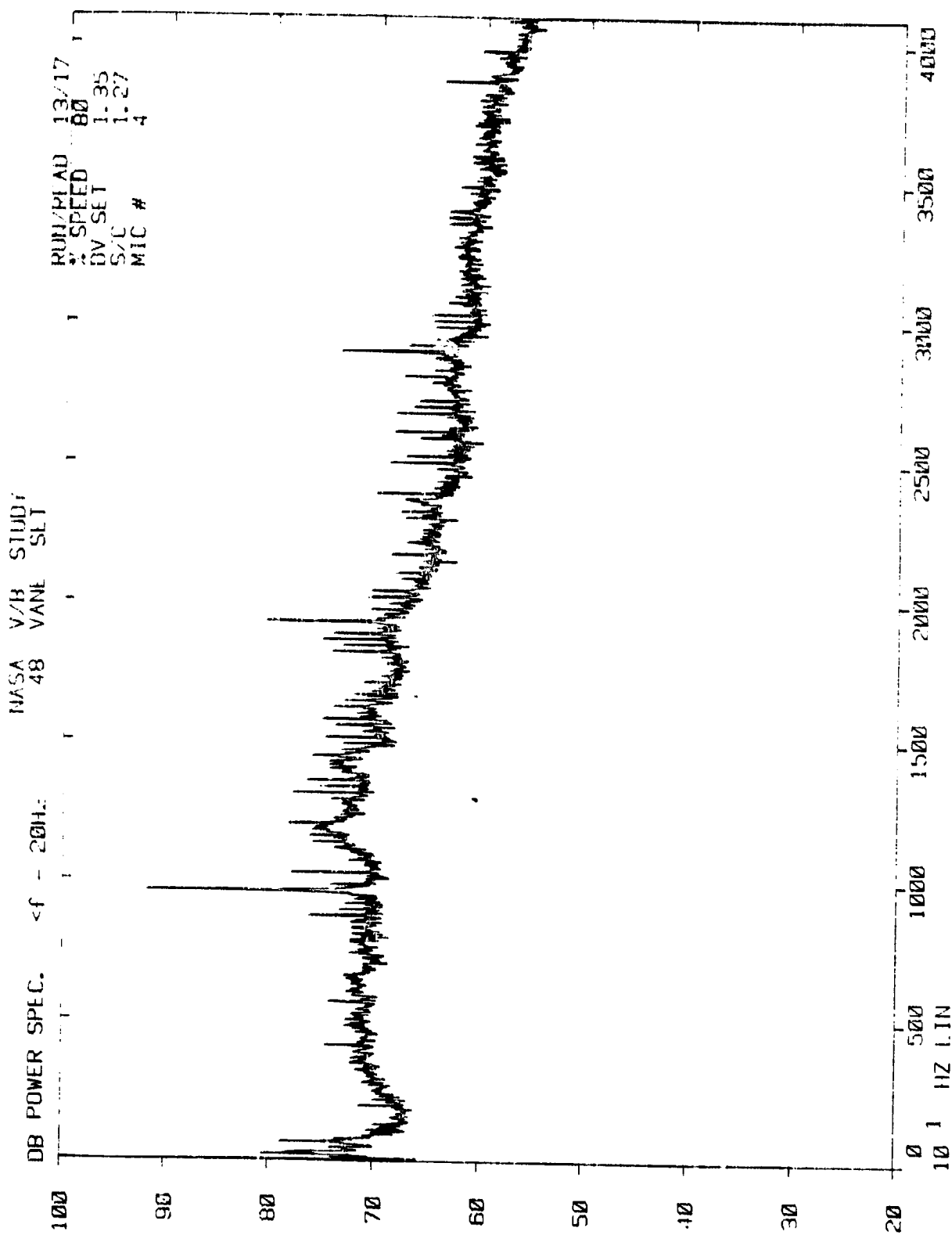








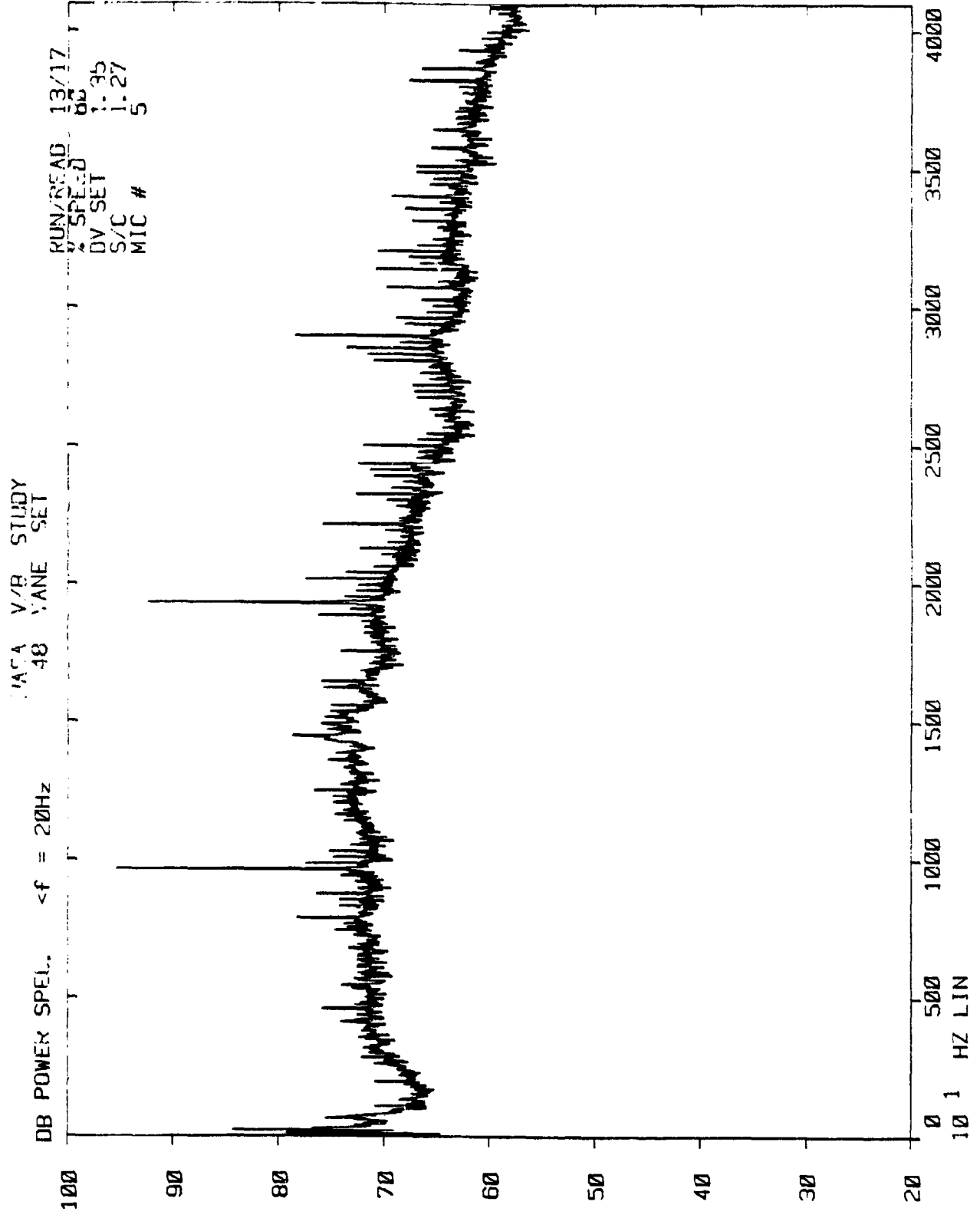




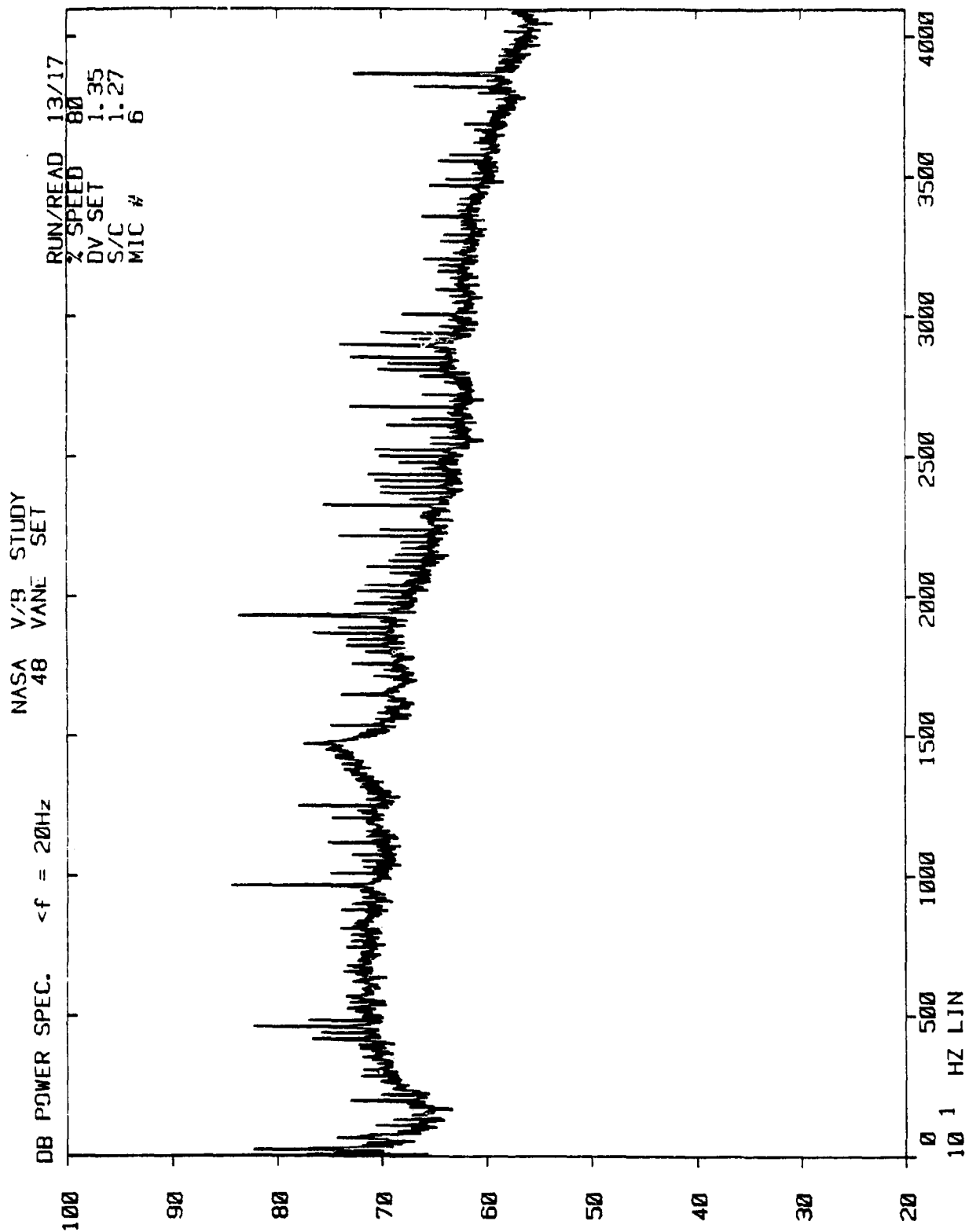


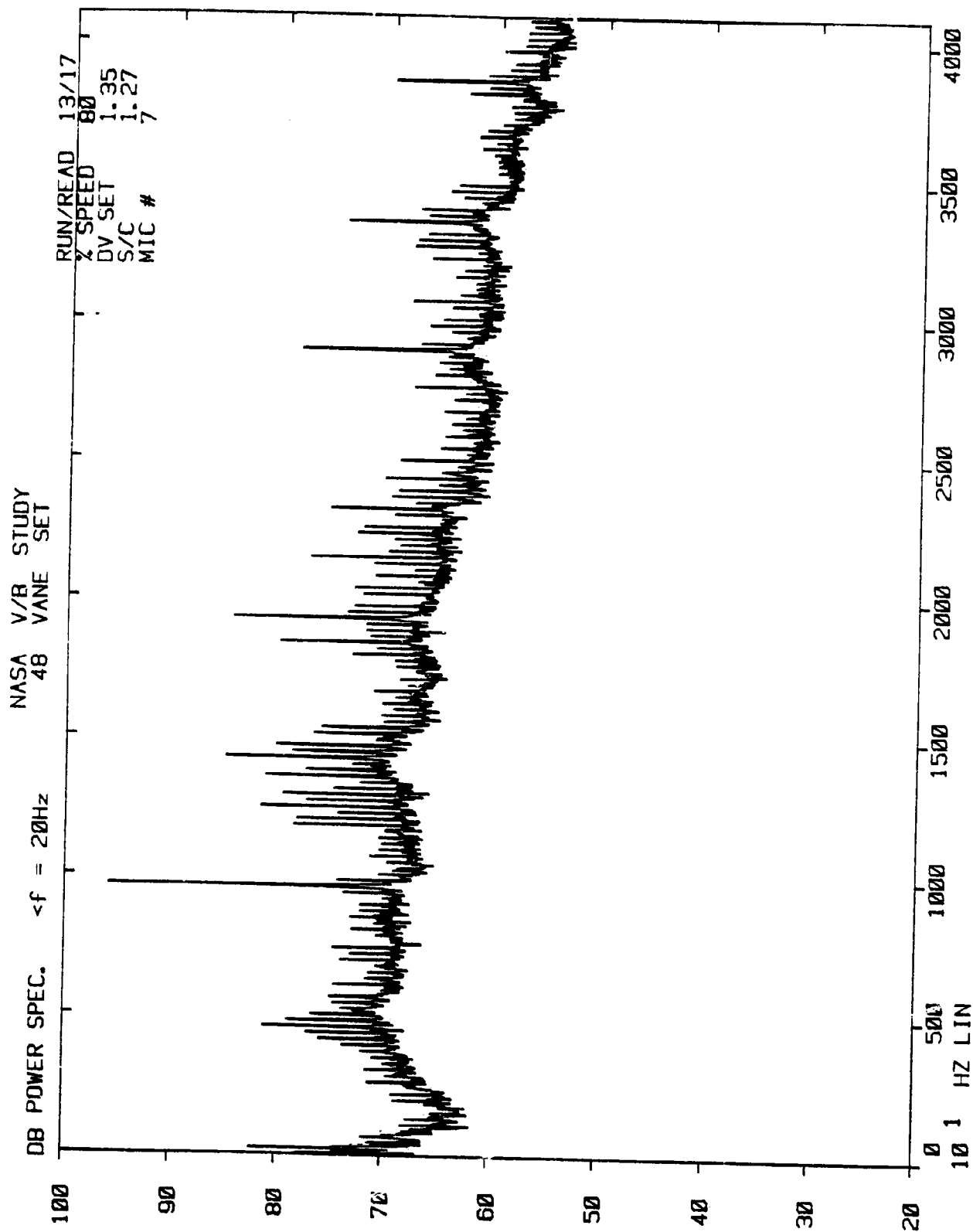
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS
STANDARD REFERENCE MATERIAL 1010a
(ANSI and ISO TEST CHART No. 2)

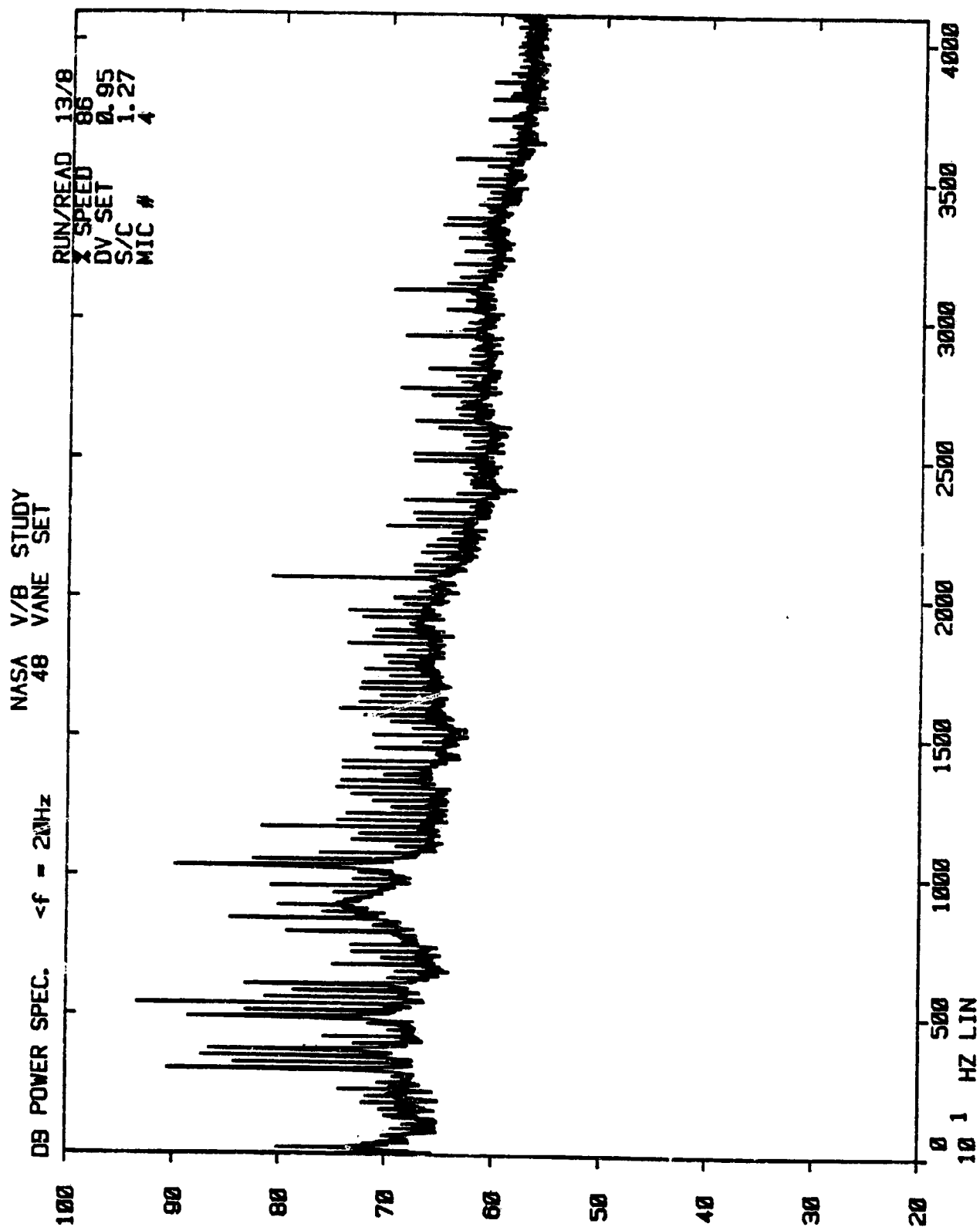


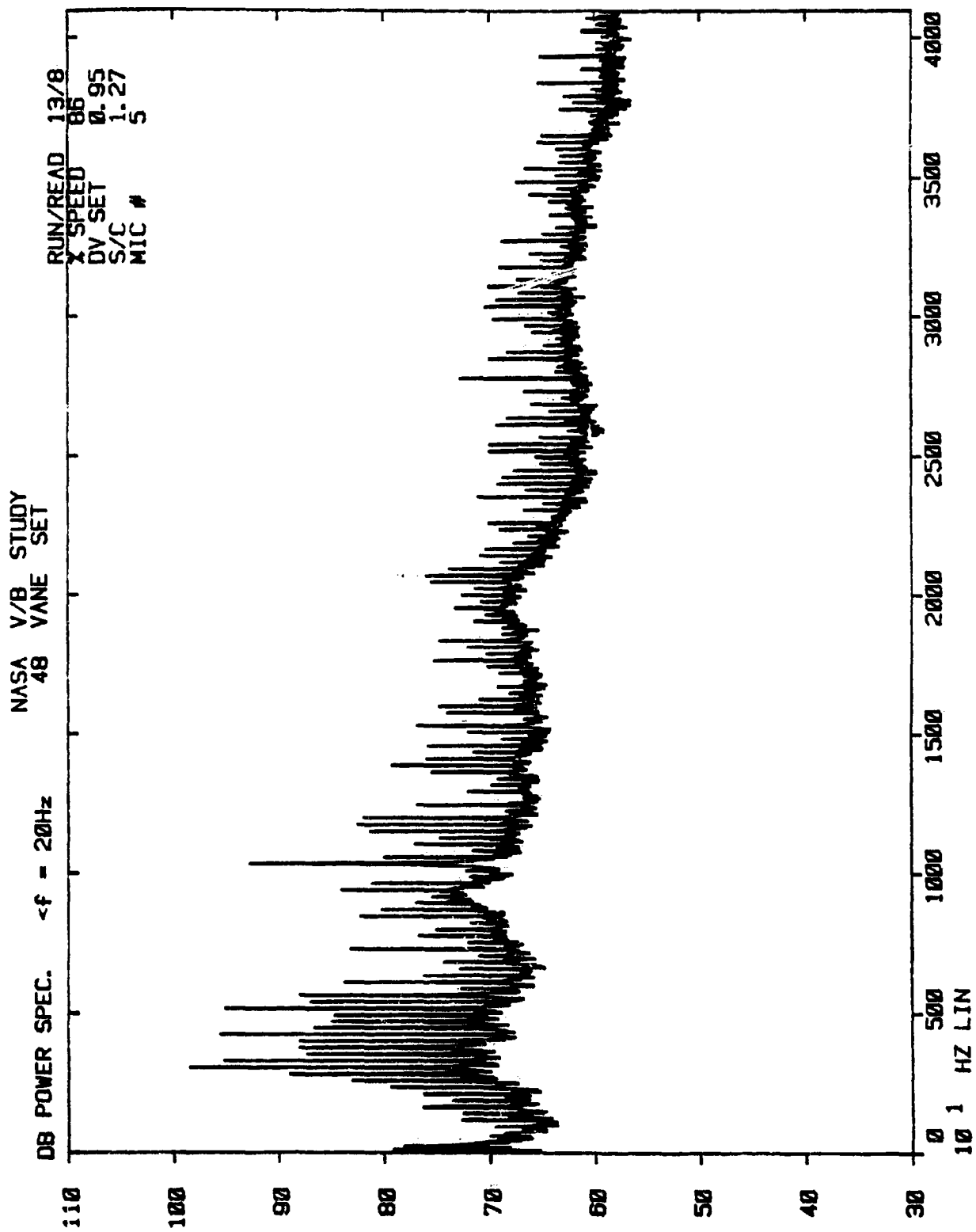


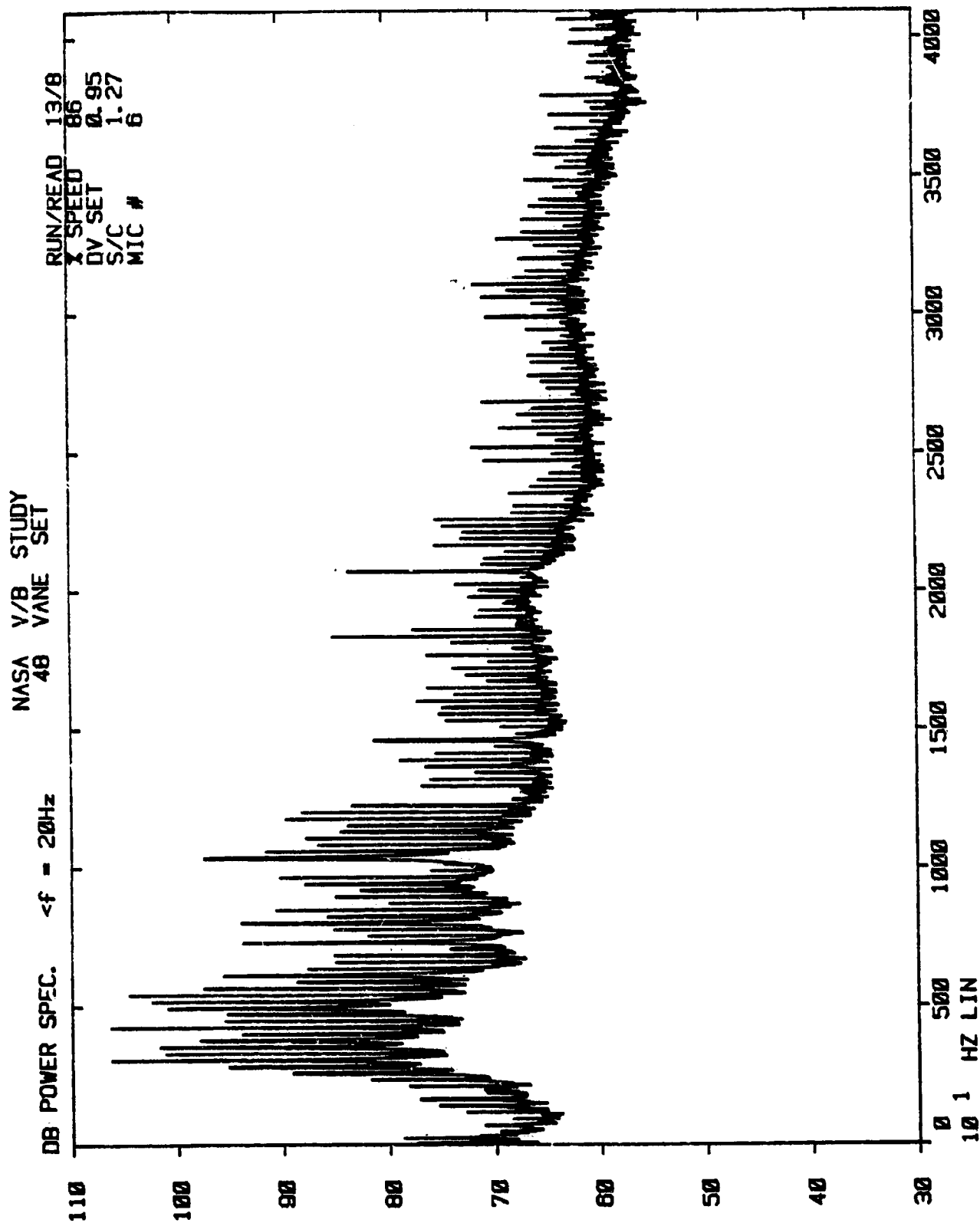
C-2





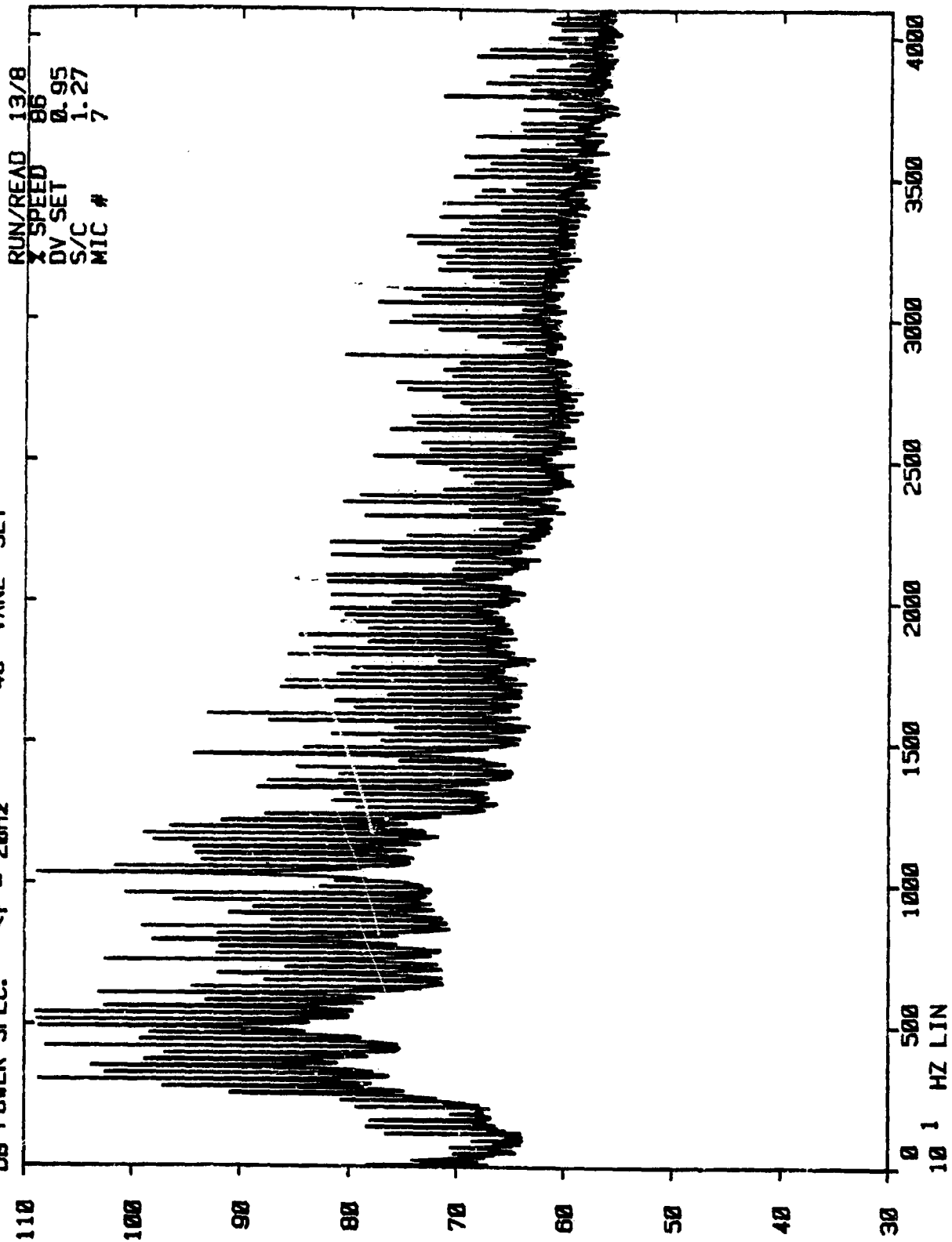


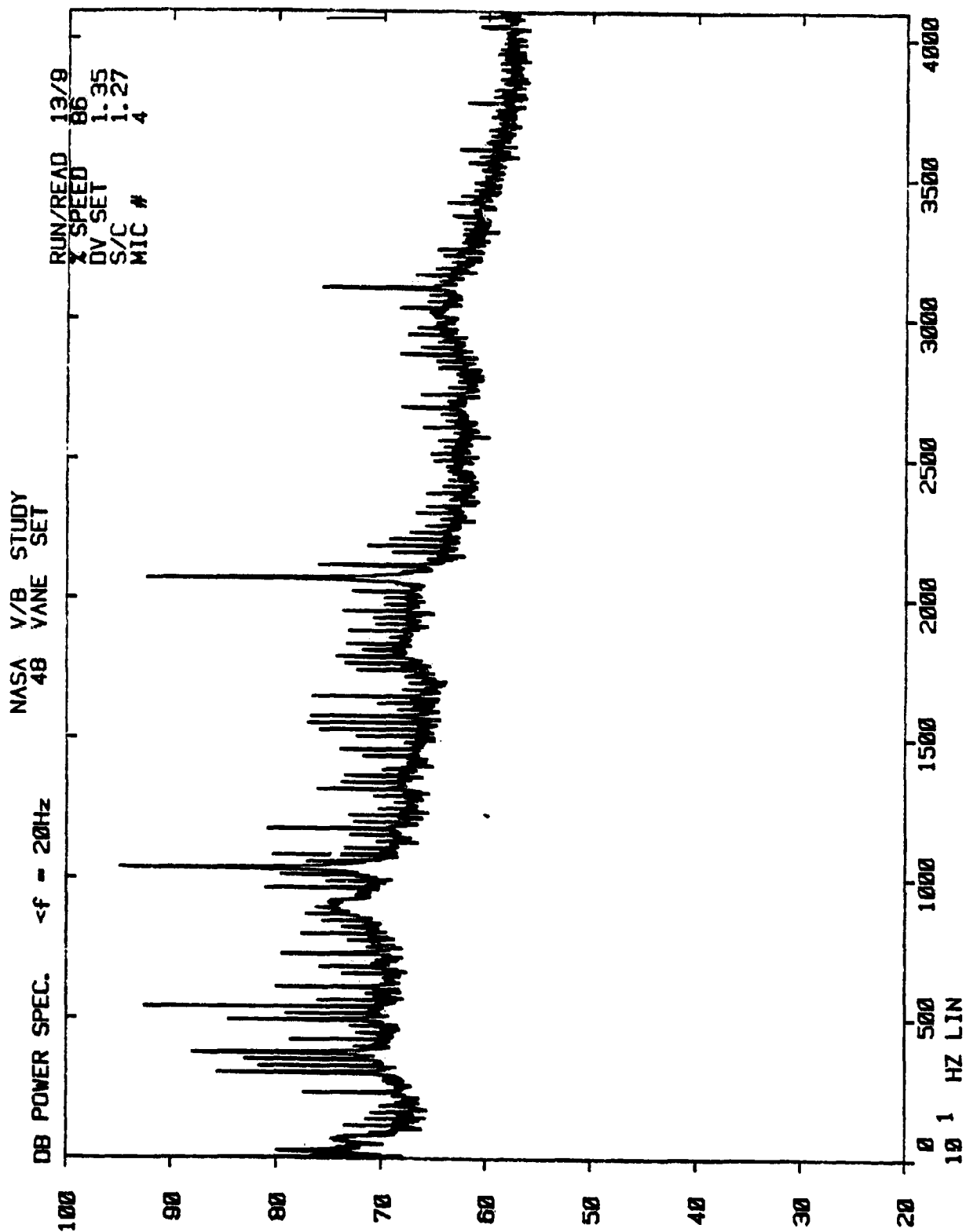


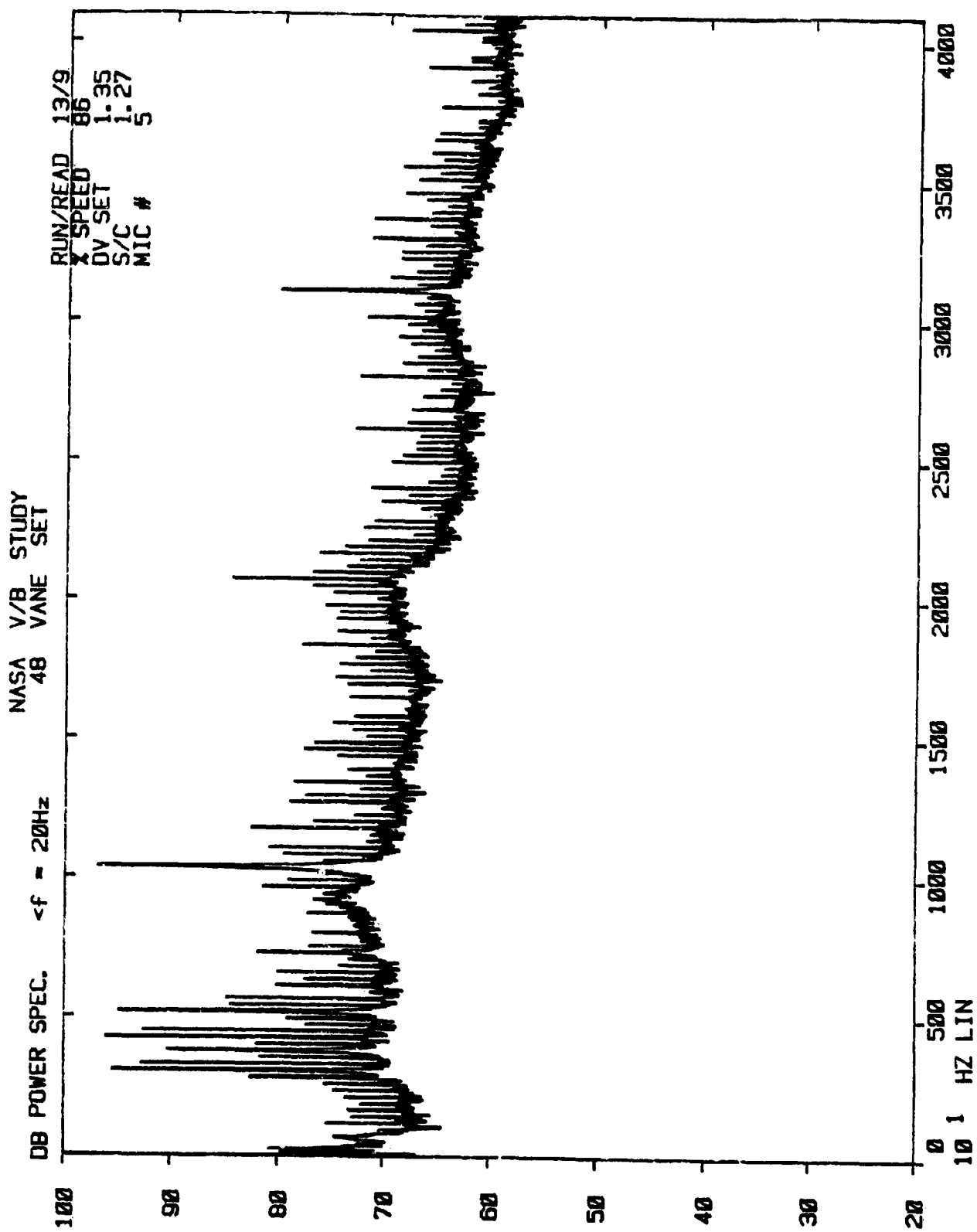


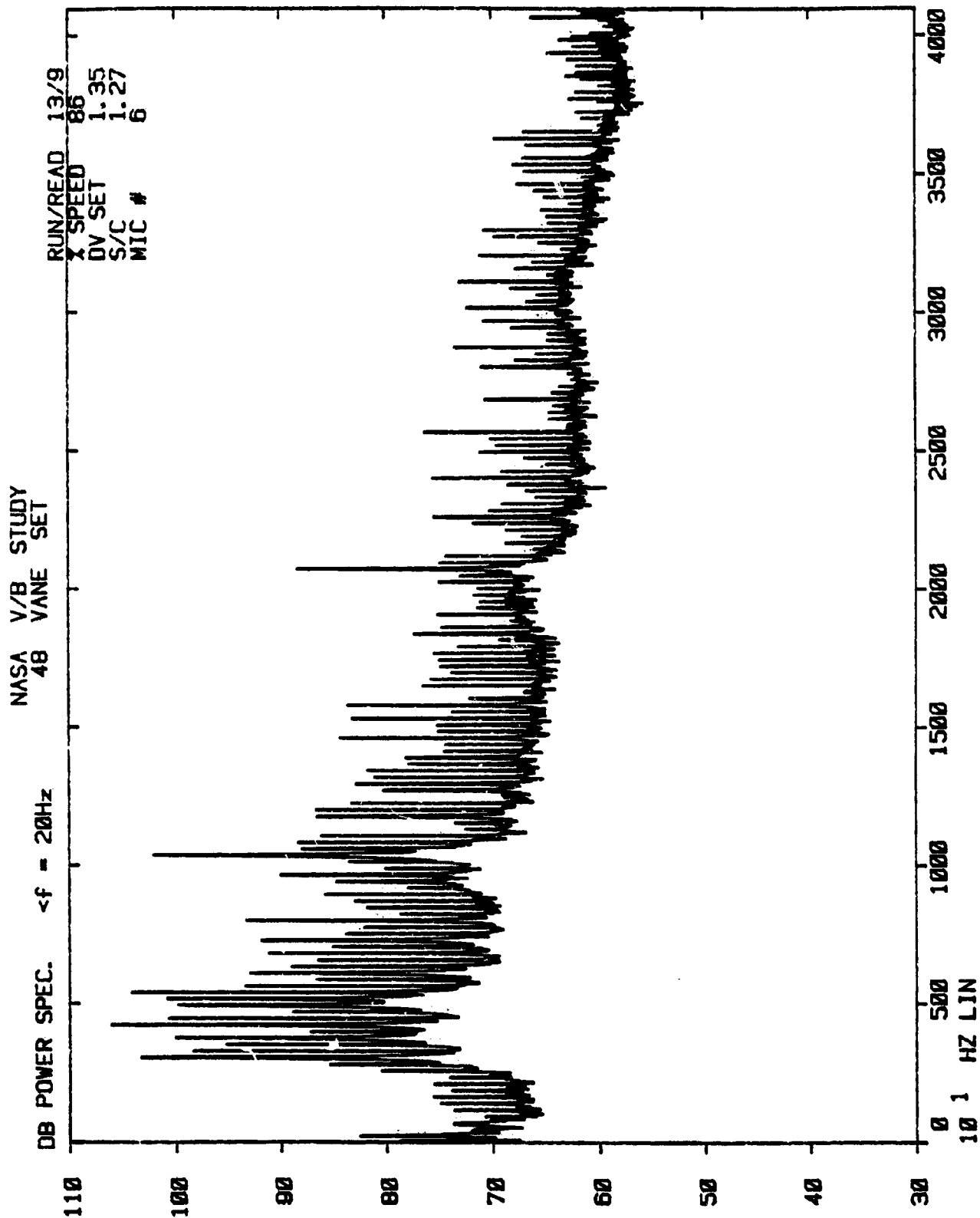
NASA V/B STUDY
48 VANE SET

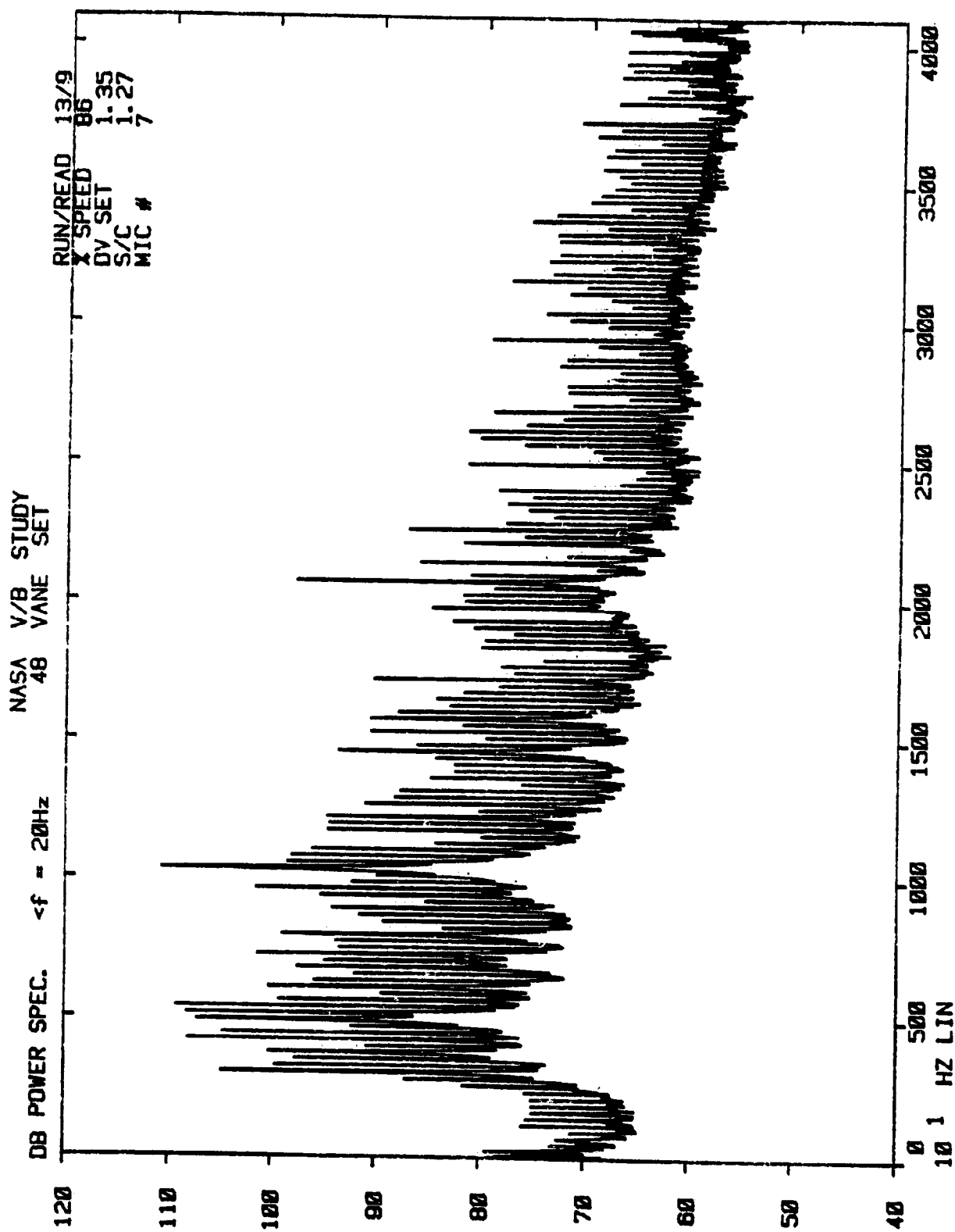
DB POWER SPEC. <f = 20Hz

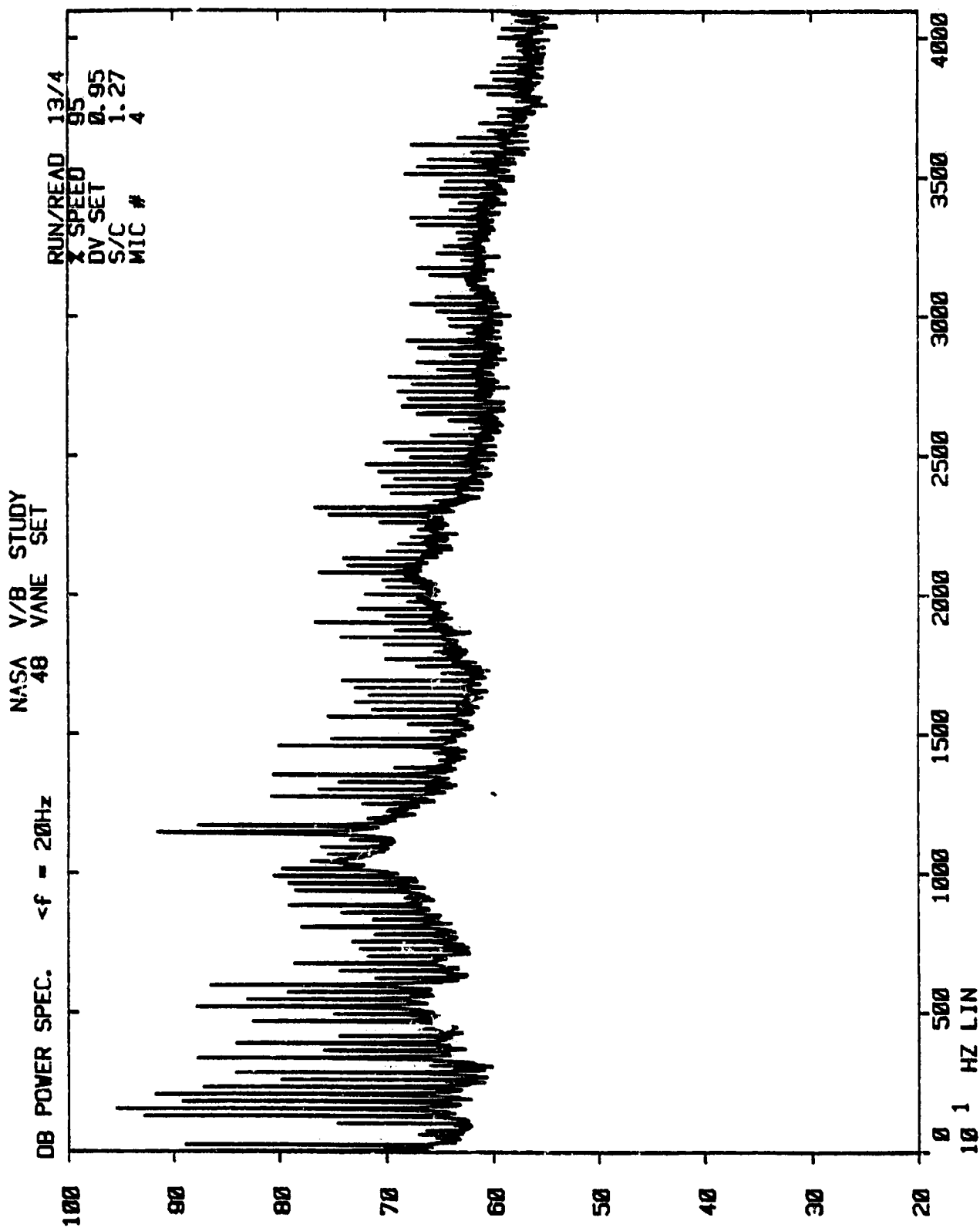








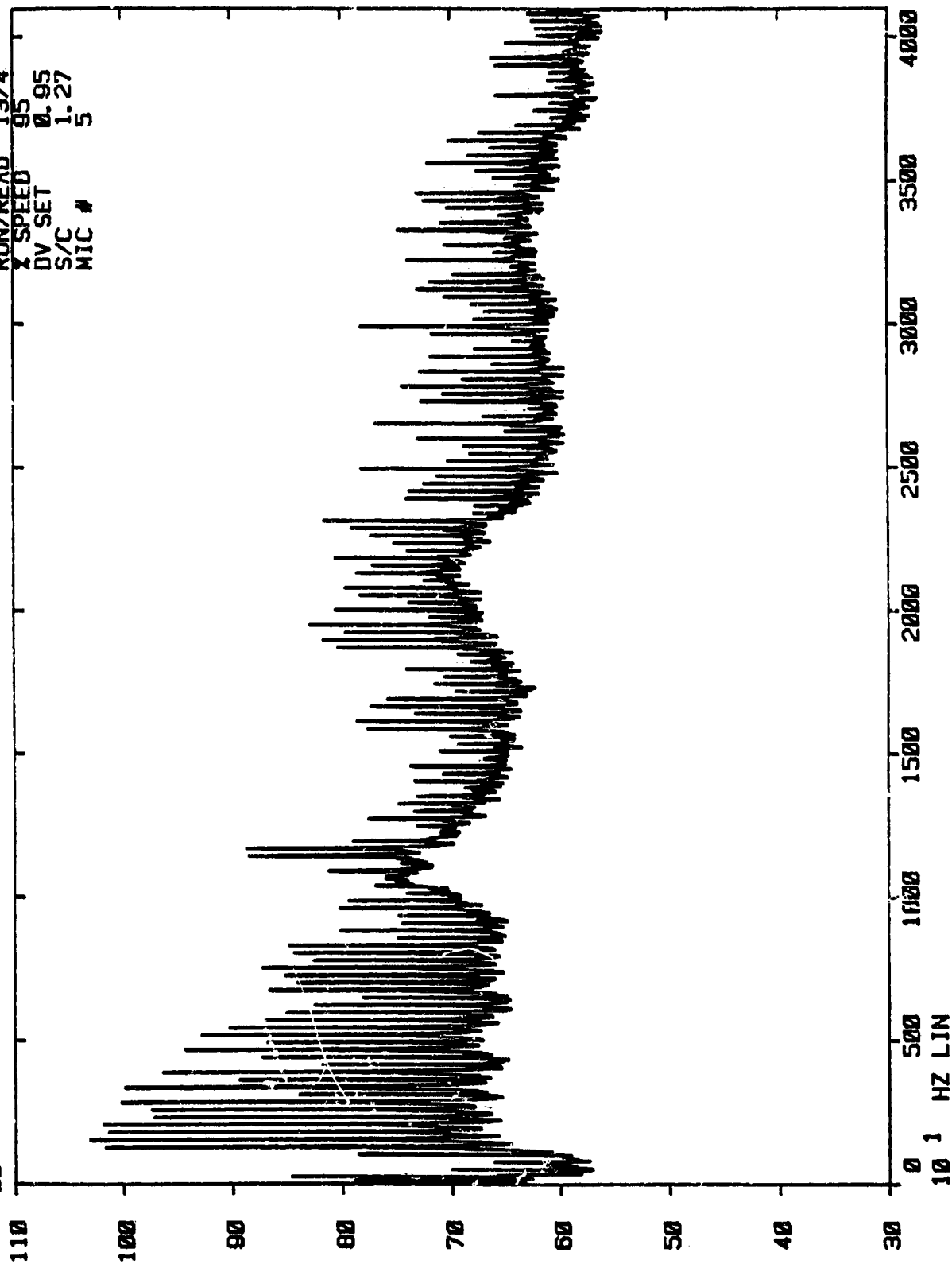


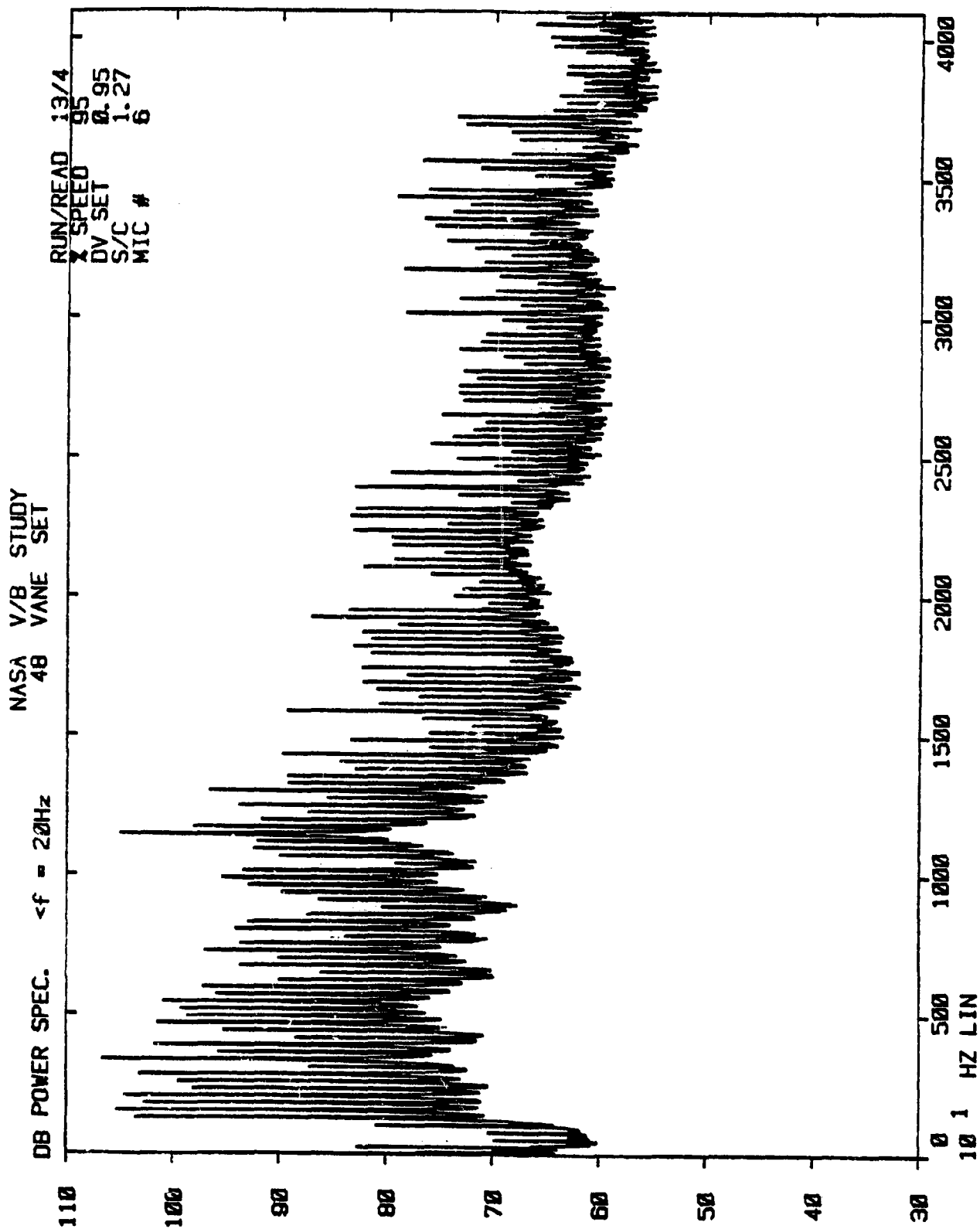


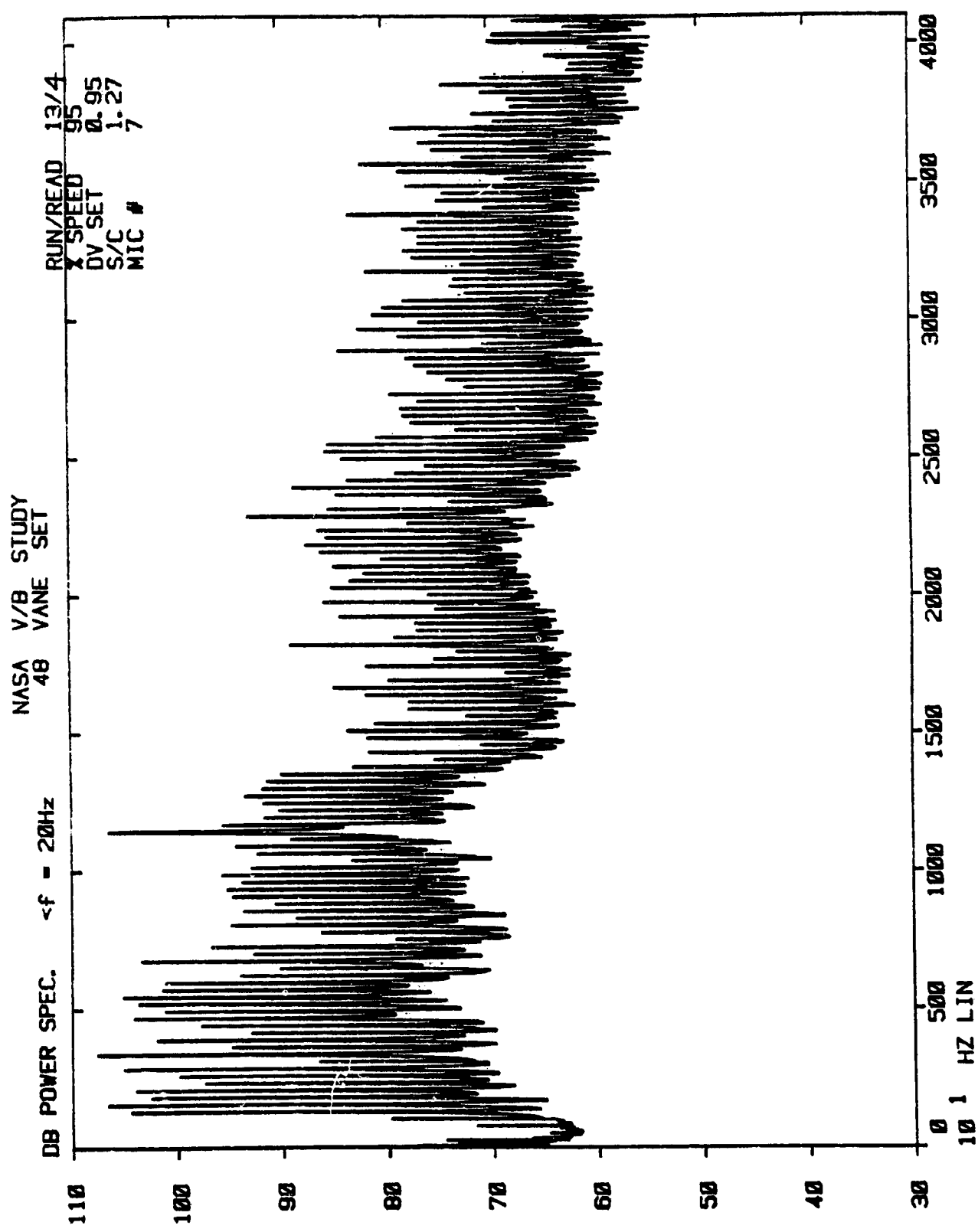
NASA V/B STUDY
48 VANE SET

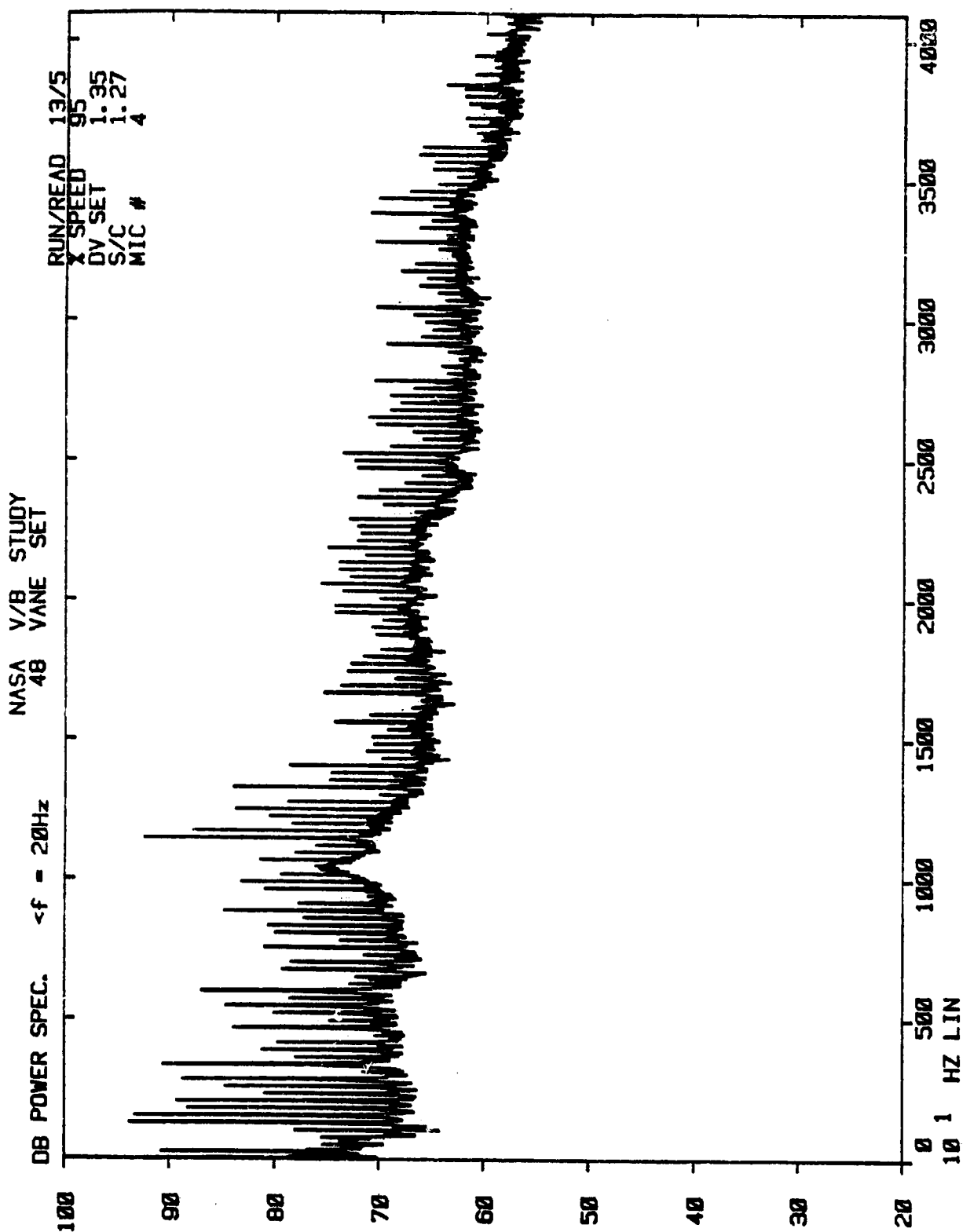
DB POWER SPEC. $< f = 20\text{Hz}$

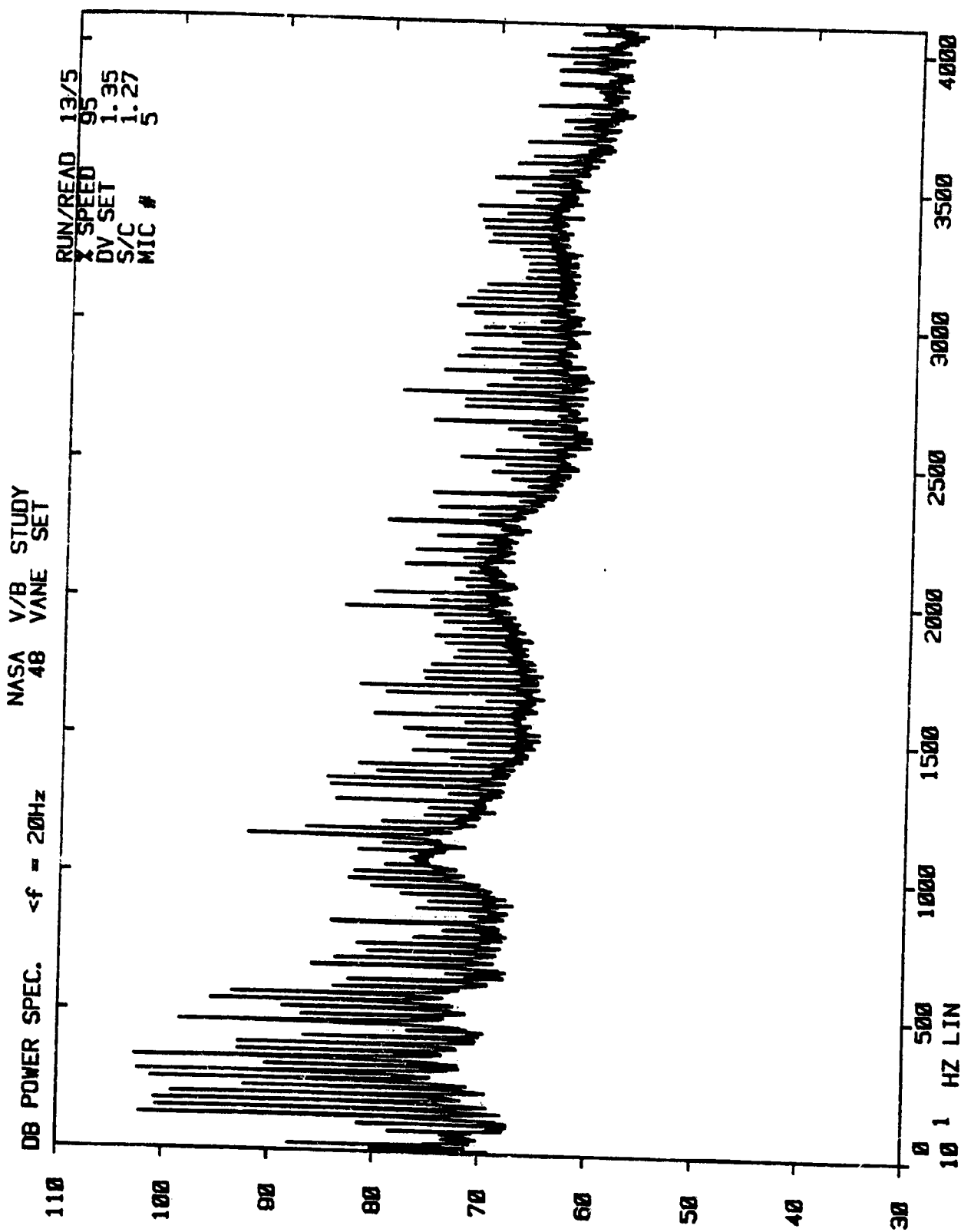
RUN/READ 13/4
X SPEED 95
DV SET 0.95
S/C 1.27
MIC # 5











NASA V/B STUDY
48 VANE SET

<f = 20Hz

DB POWER SPEC.

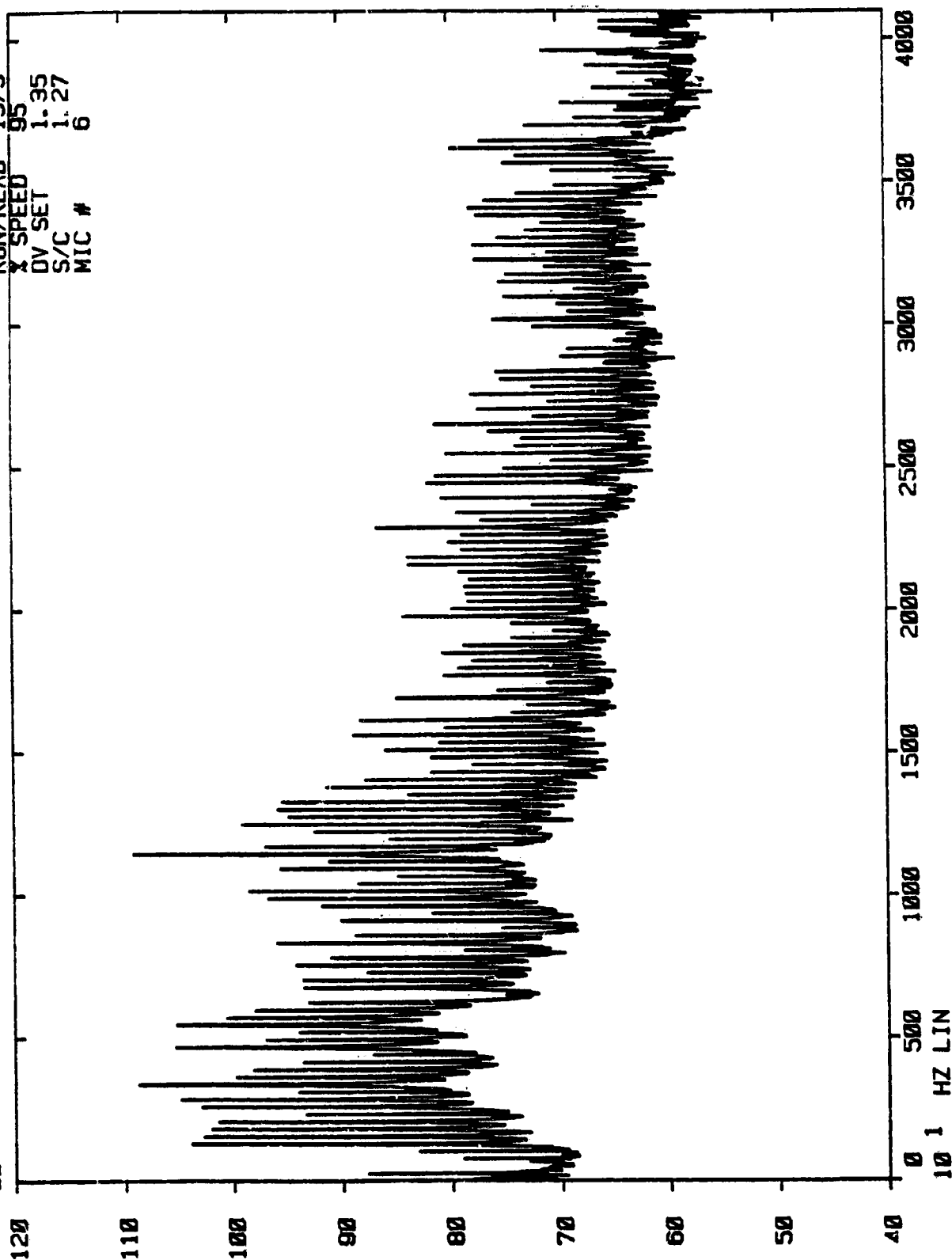
RUN/READ 13/5

X SPEED 95

OV SET 1.35

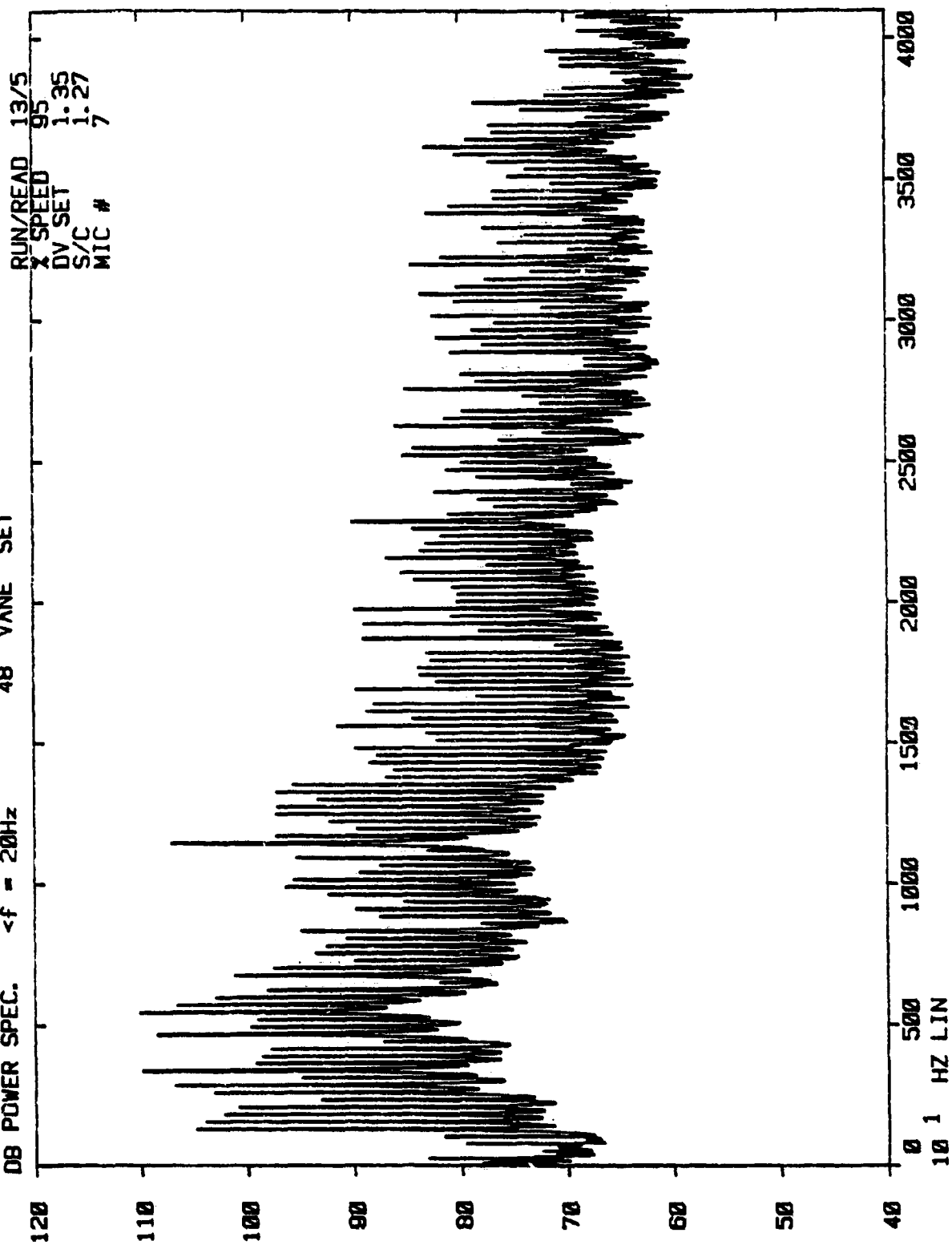
S/C 1.27

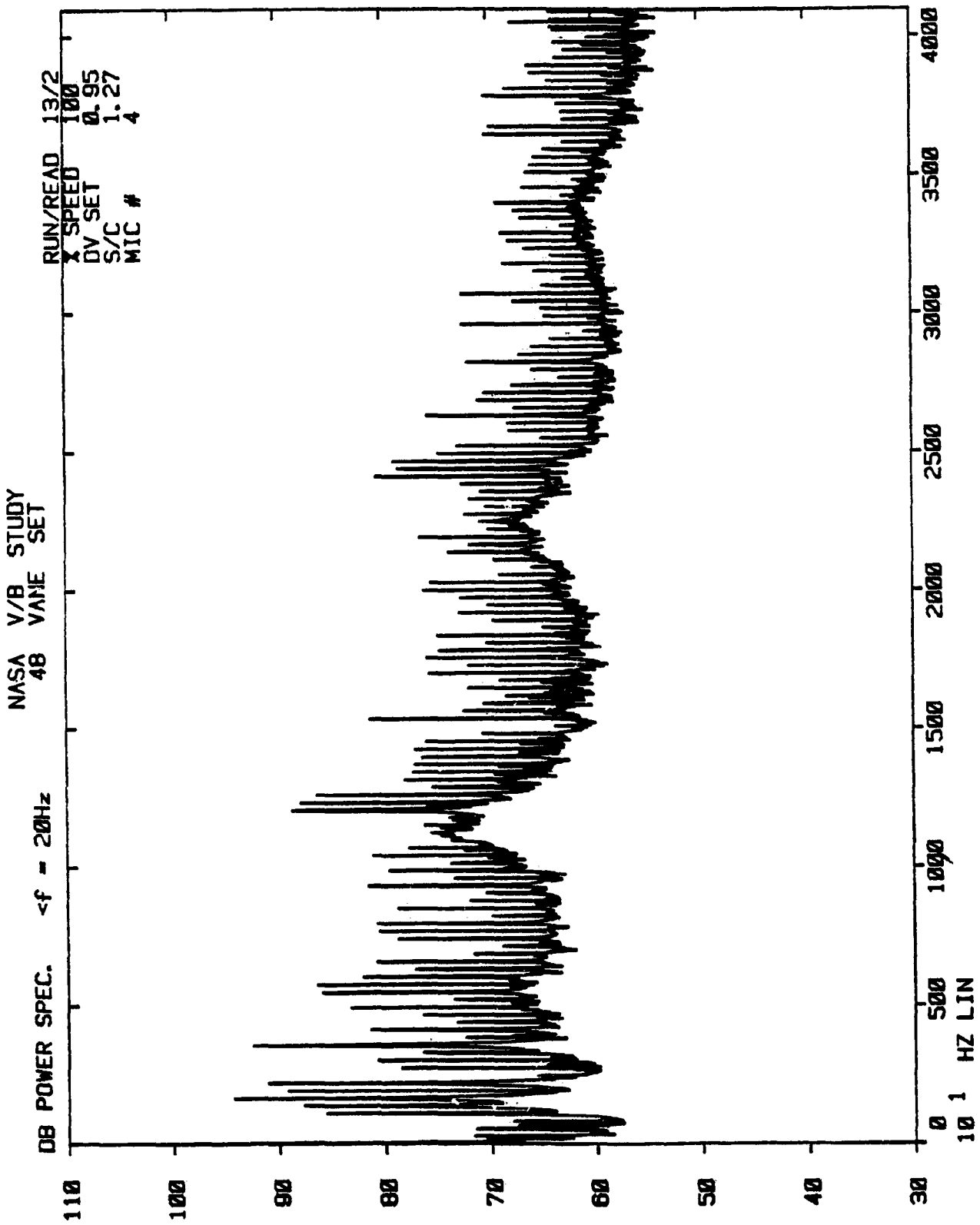
MIC # 6



NASA V/B STUDY
48 VANE SET

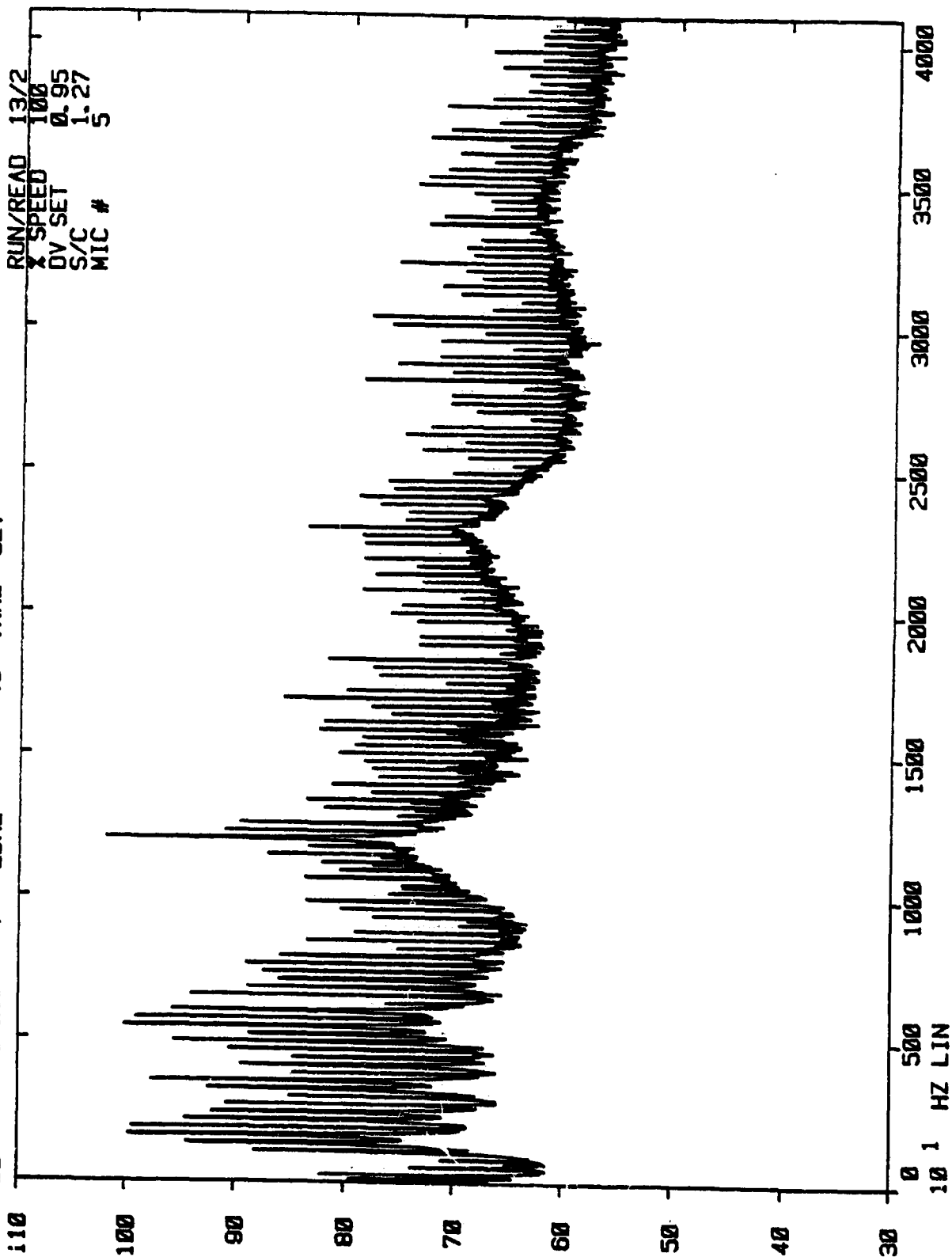
DB POWER SPEC. $< f = 20\text{Hz}$





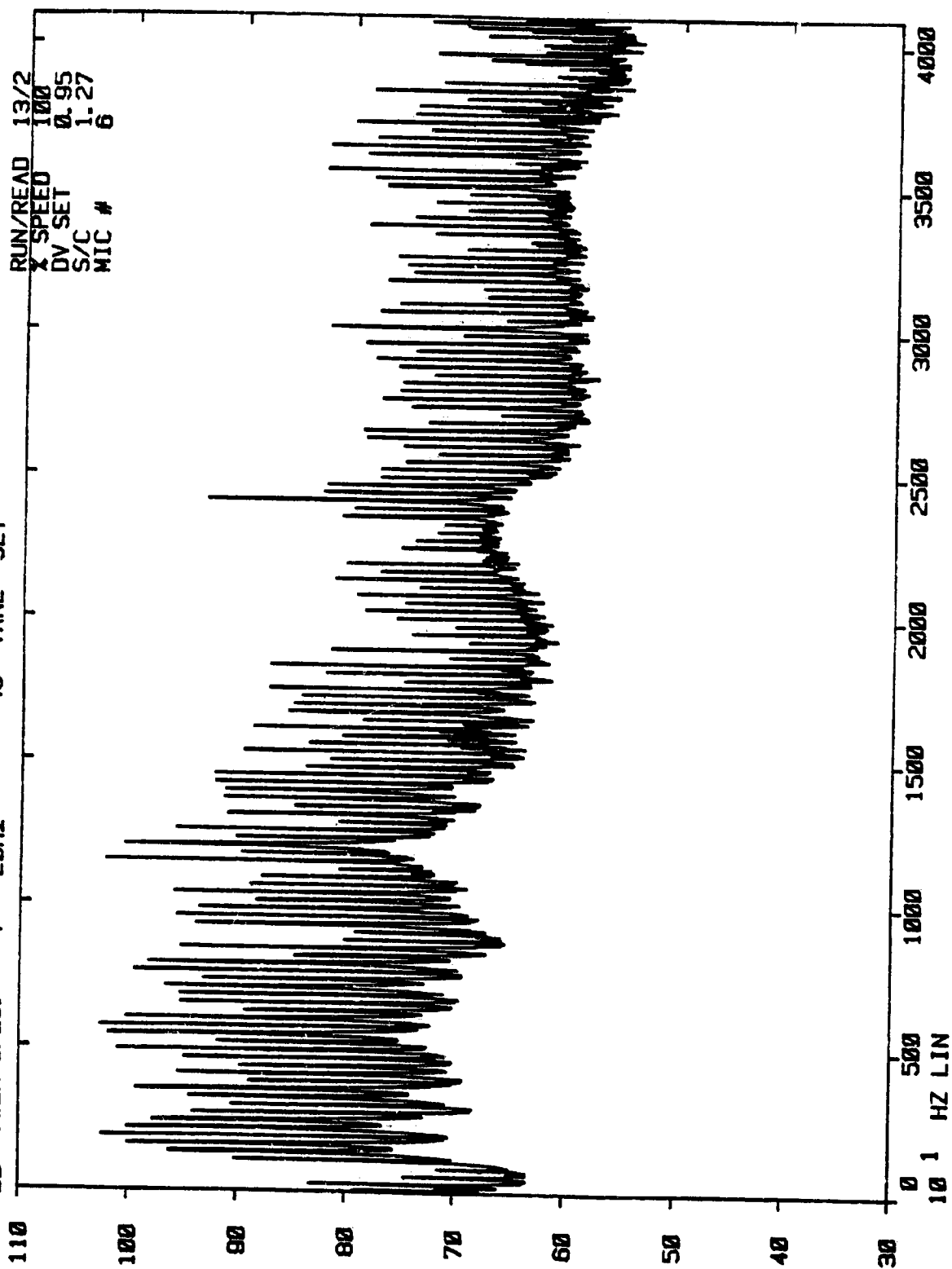
NASA V/B STUDY
48 VANE SET

DB POWER SPEC. $\Delta f = 20\text{Hz}$



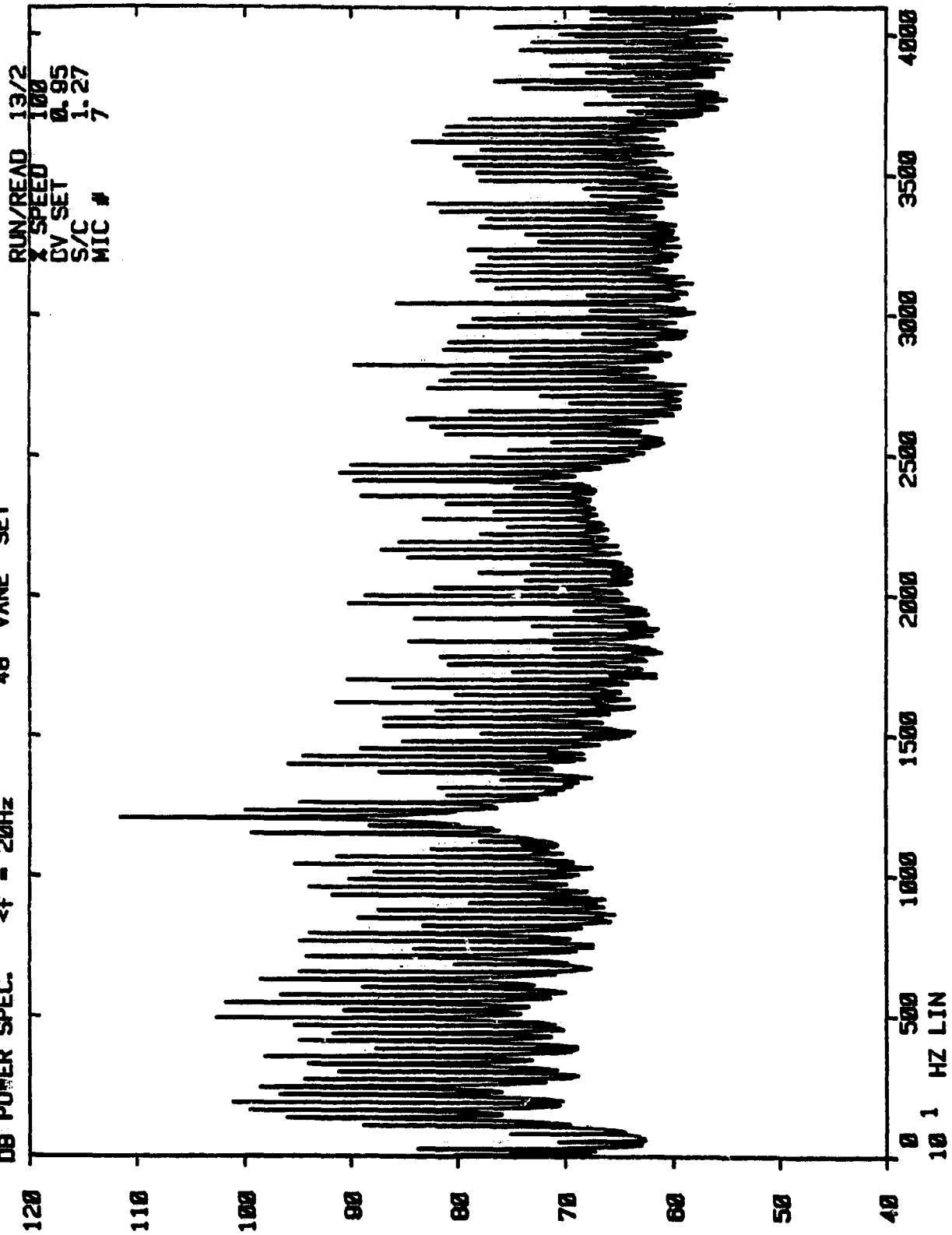
NASA V/B STUDY
48 VANE SET

DB POWER SPEC. <f = 20Hz



NASA V/B STUDY
48 VANE SET

DB POWER SPEC. $< f = 20\text{Hz}$

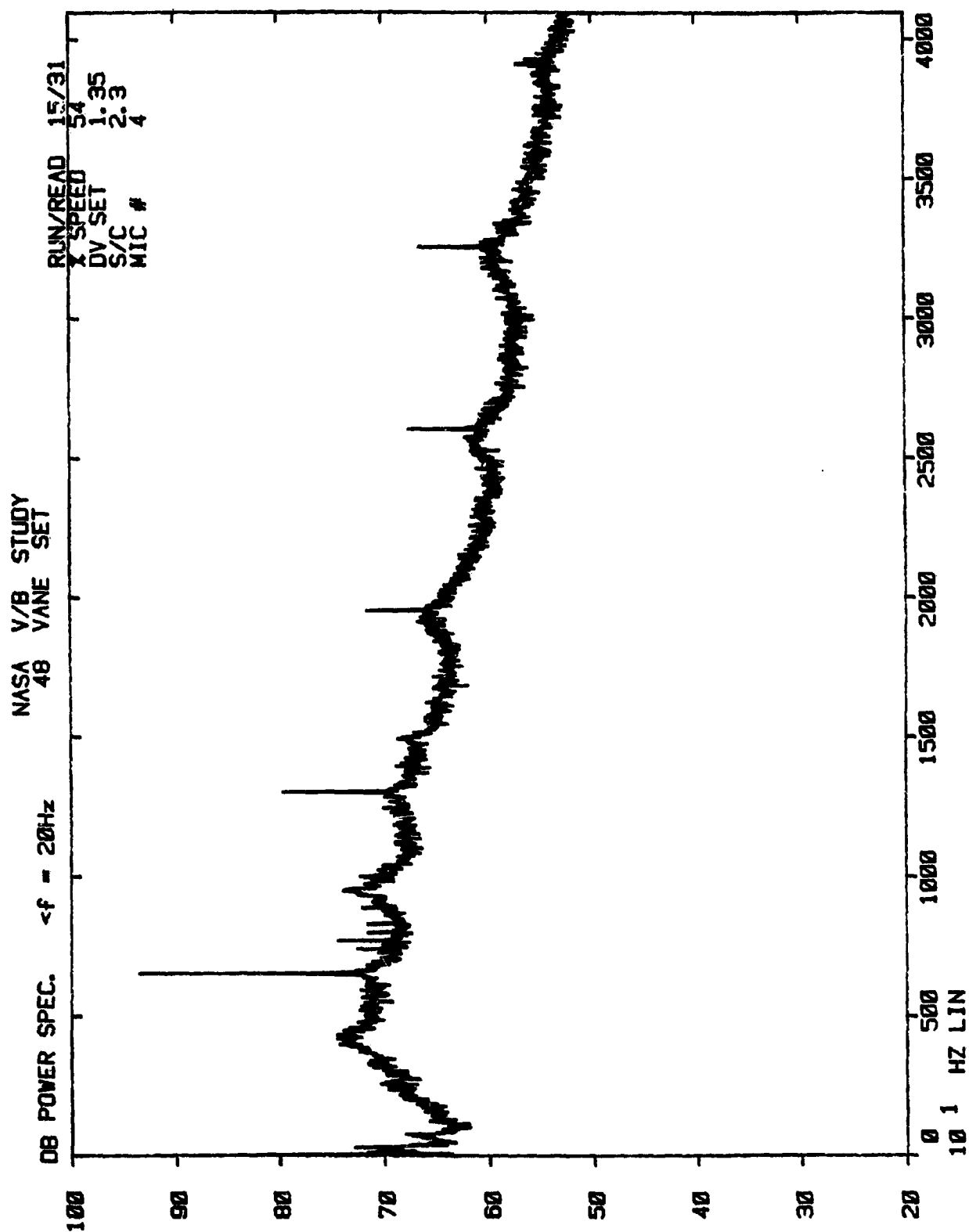


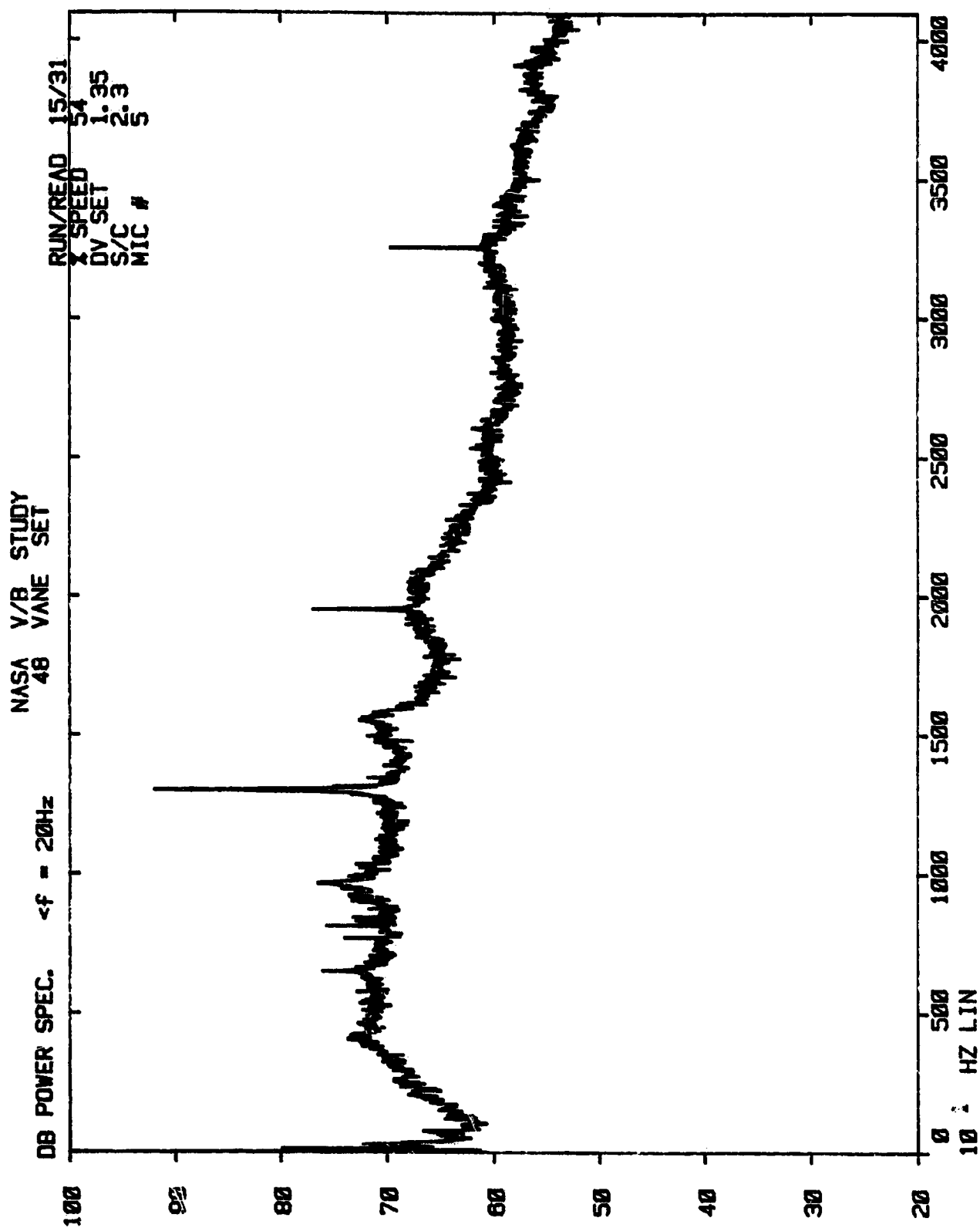
NARROWBAND SPECTRA (20 Hz.)

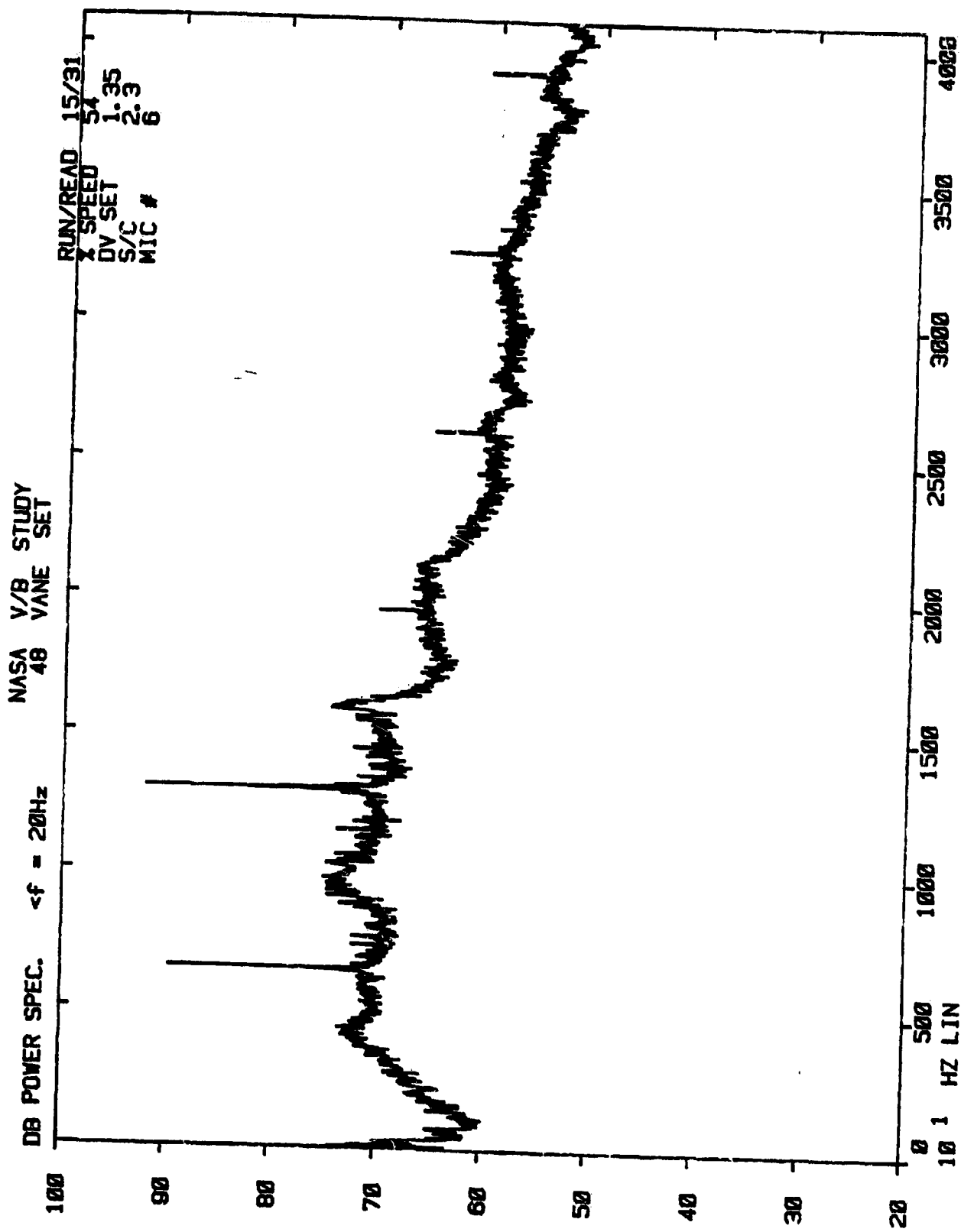
MICROPHONES 4 THRU 7 (30° - 60°)

• 48 VANES, $S/C = 2.3$

<u>RUN/RDG.</u>	<u>%NF</u>	<u>DV</u>	<u>REMARKS</u>
15/17	100	0.88	
15/19	95	0.88	
15/20	95	1.35	
15/21	86	0.88	
15/22	86	1.35	
15/23	80	1.35	
15/24	80	0.88	
15/25	76	0.88	
15/26	76	1.36	
15/27	69	1.35	
15/28	69	0.88	
15/29	63	0.88	
15/30	63	1.35	
15/31	54	1.35	

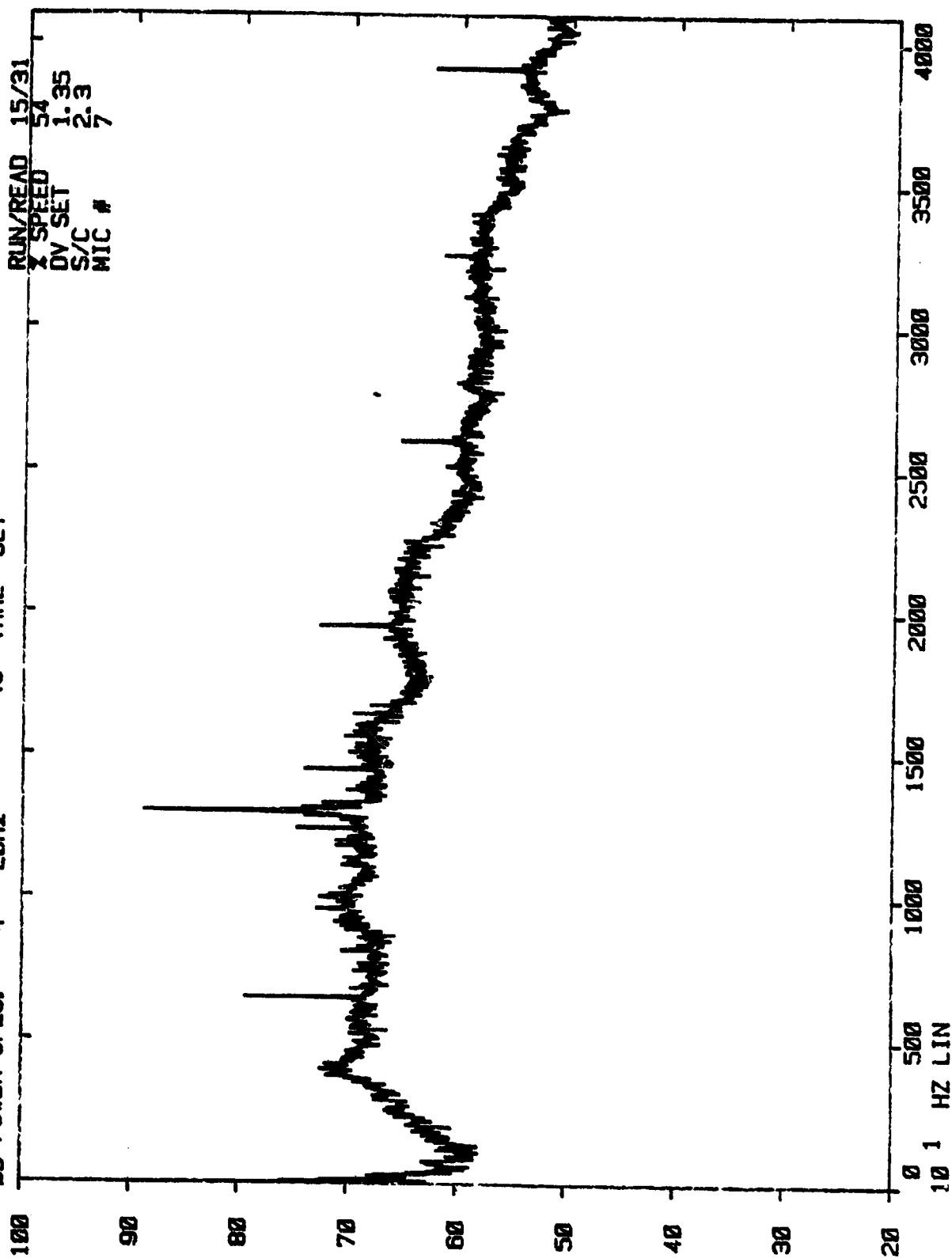


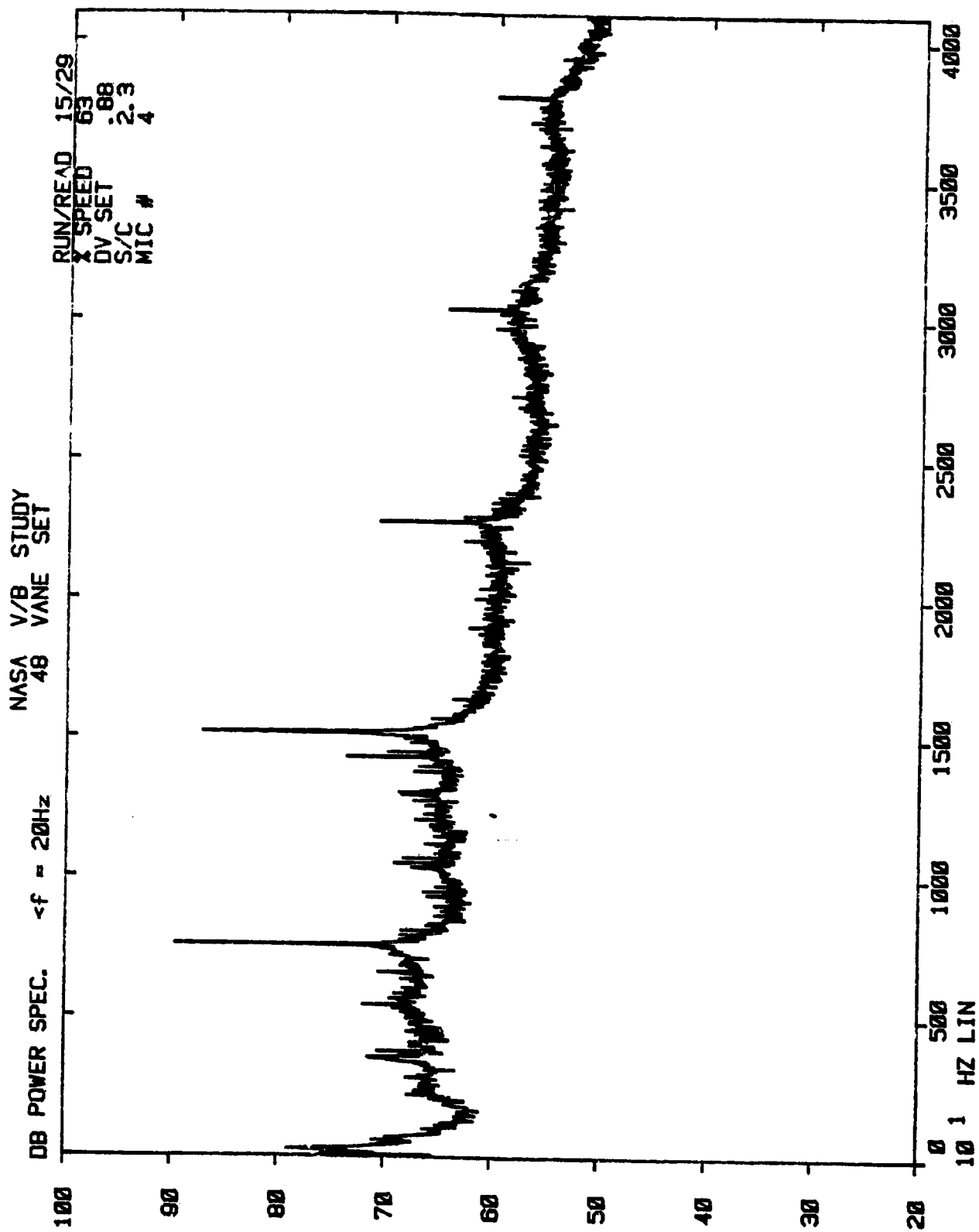


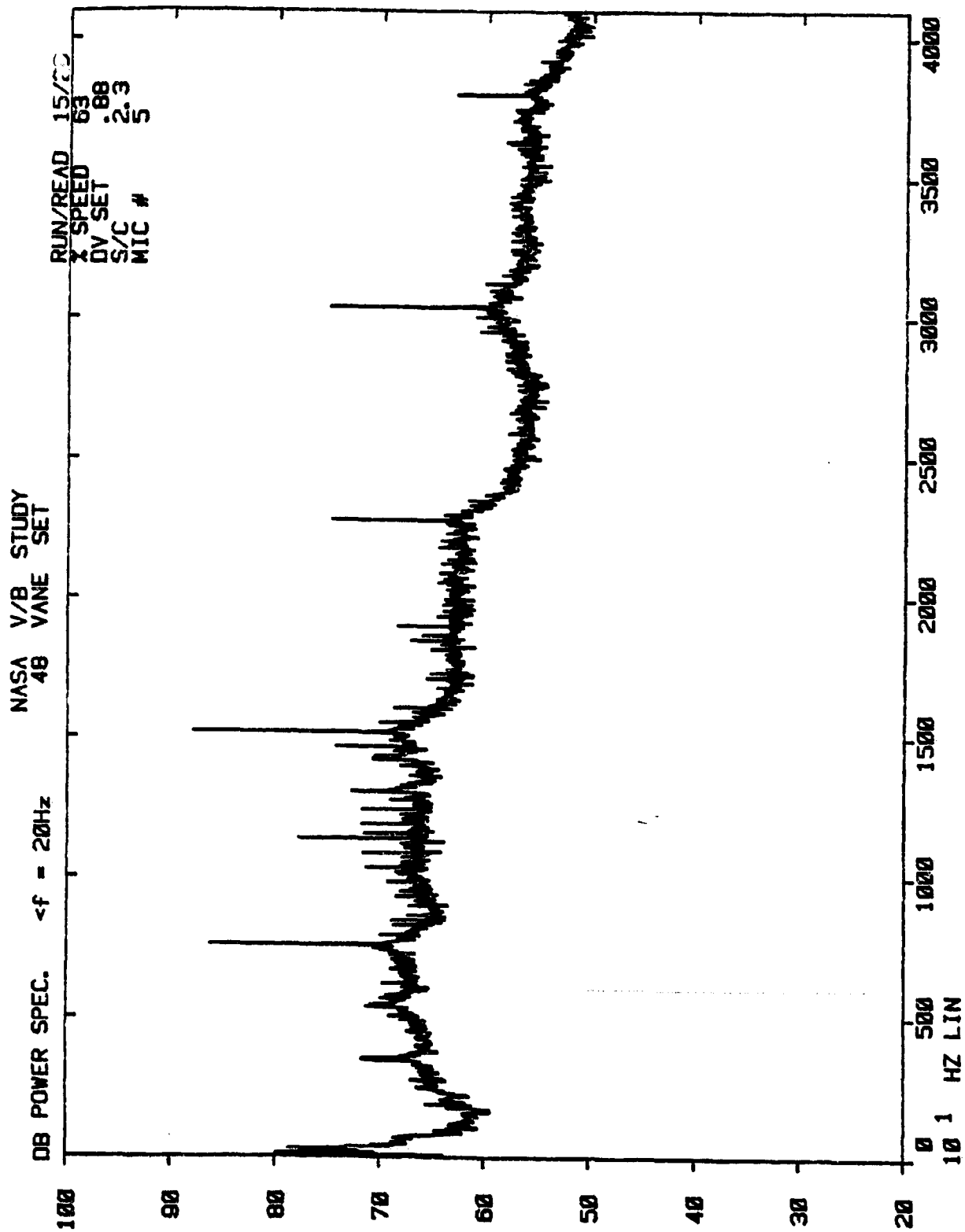


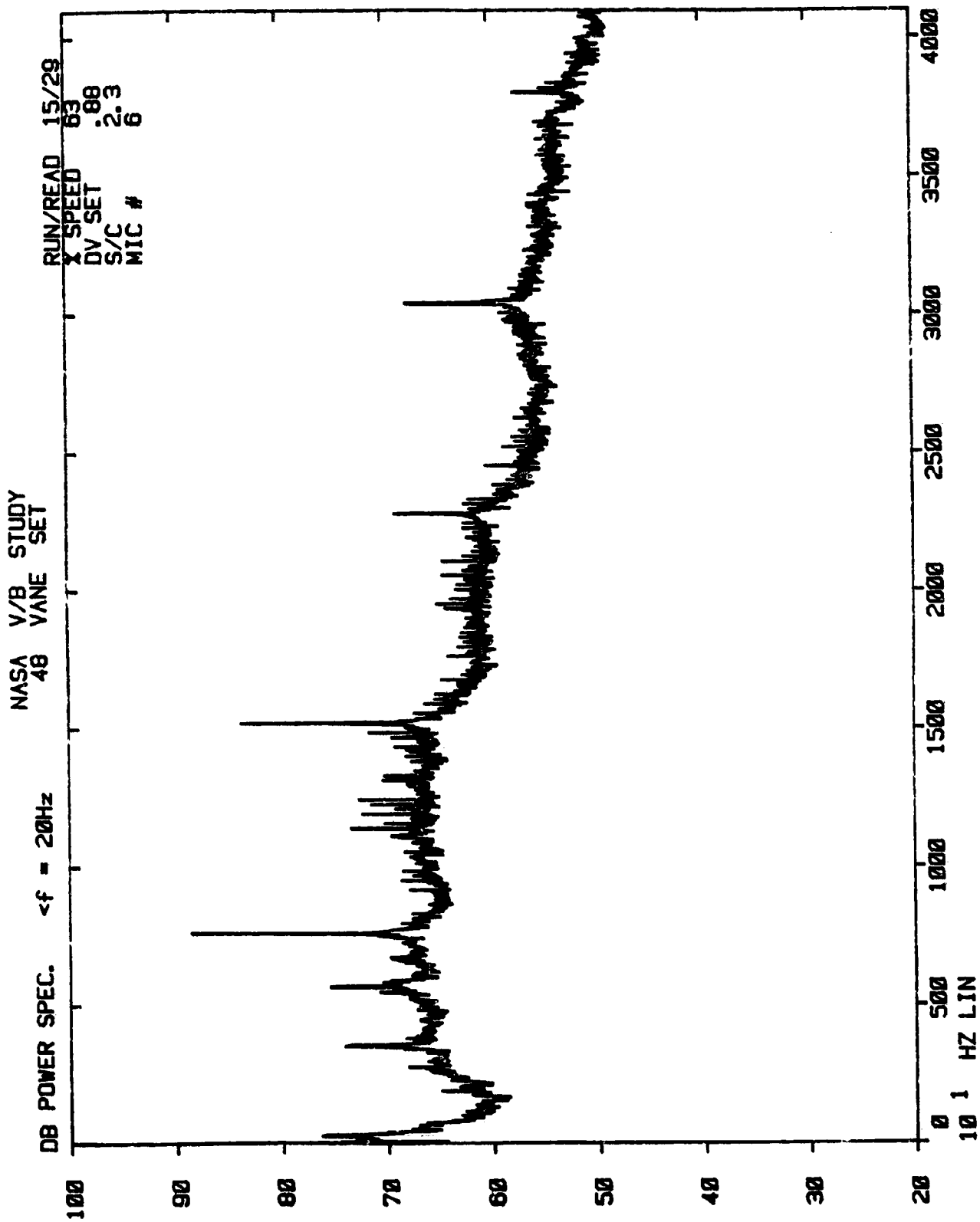
NASA V/B STUDY
48 VANE SET

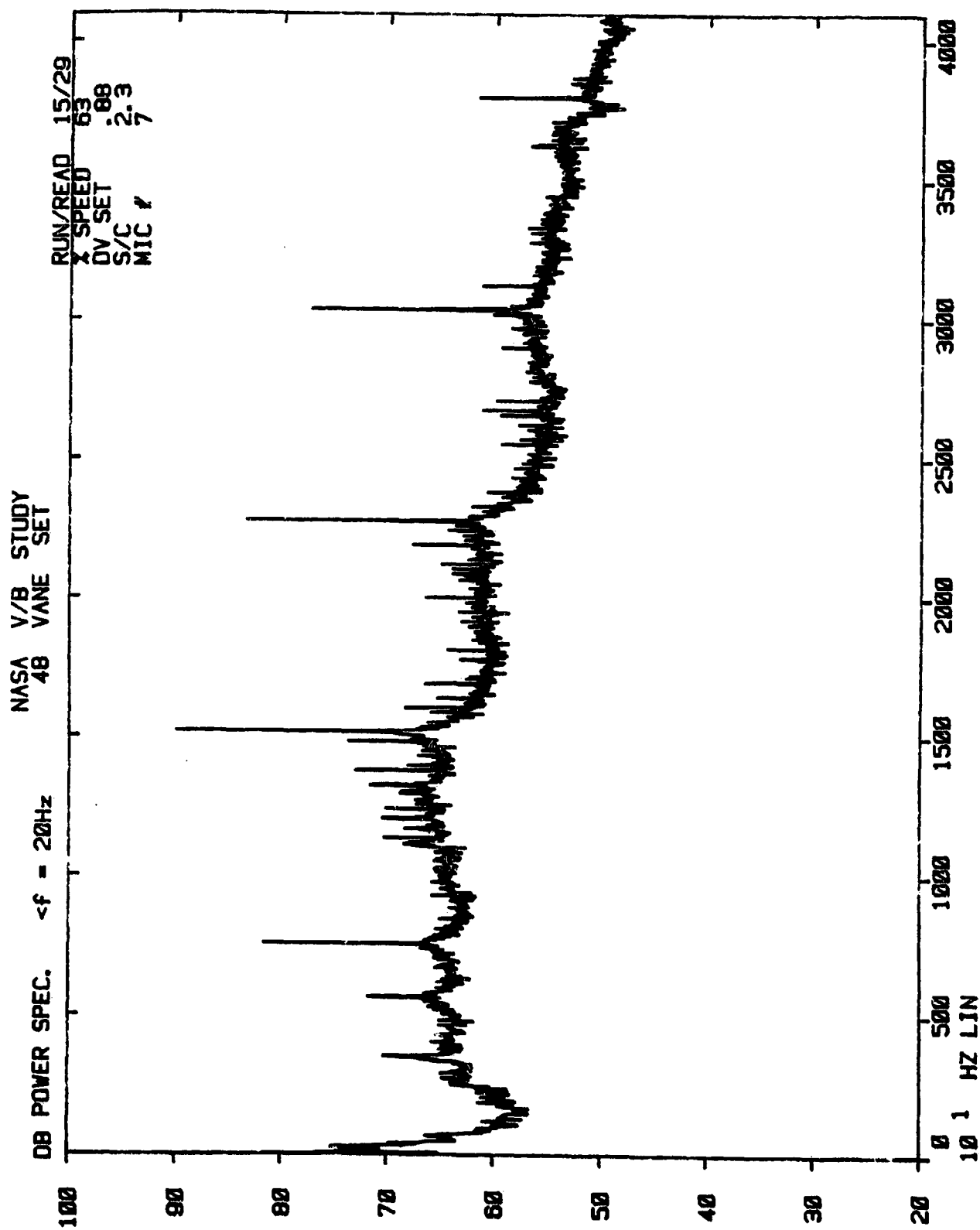
DB POWER SPEC. $< f = 20\text{Hz}$

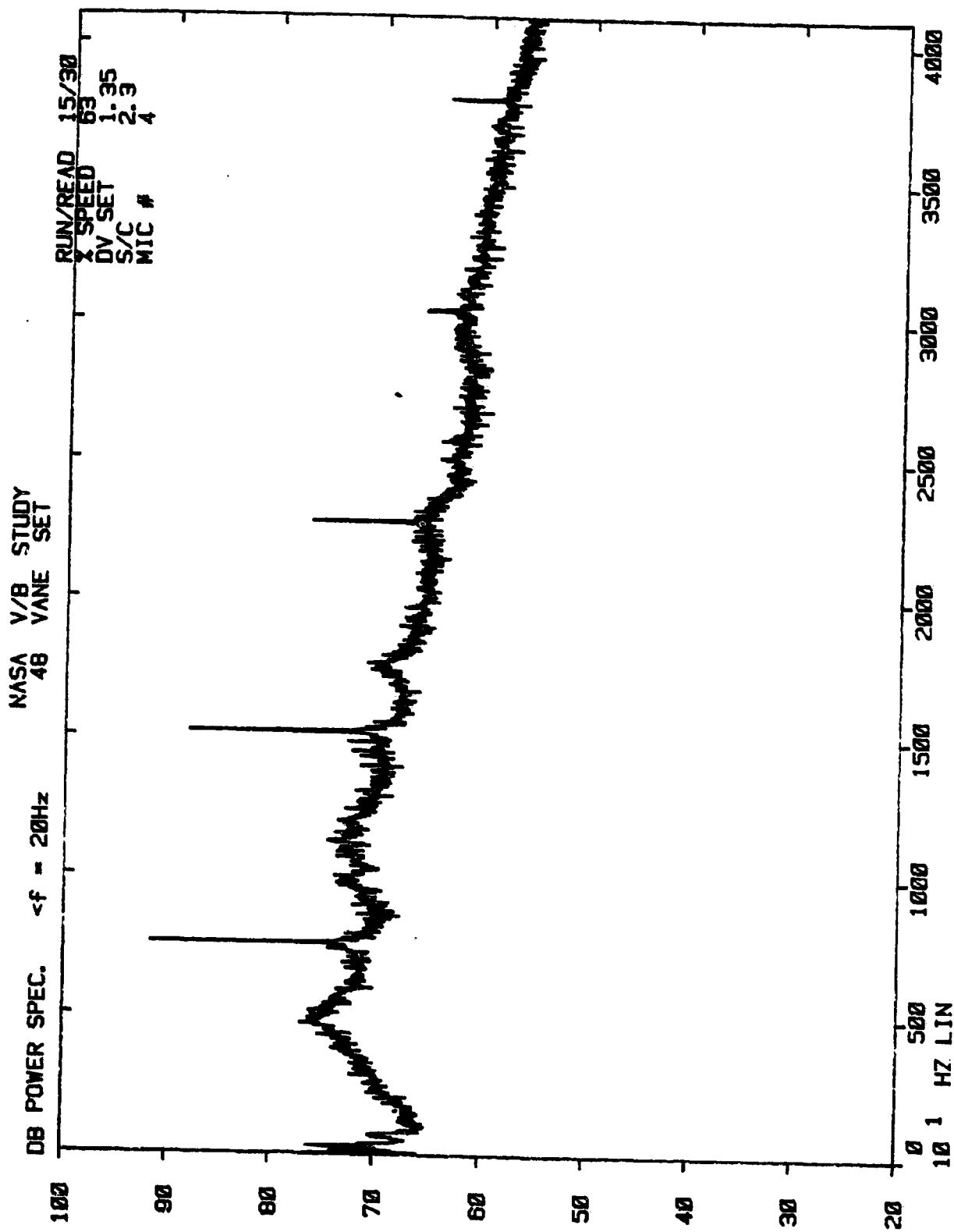


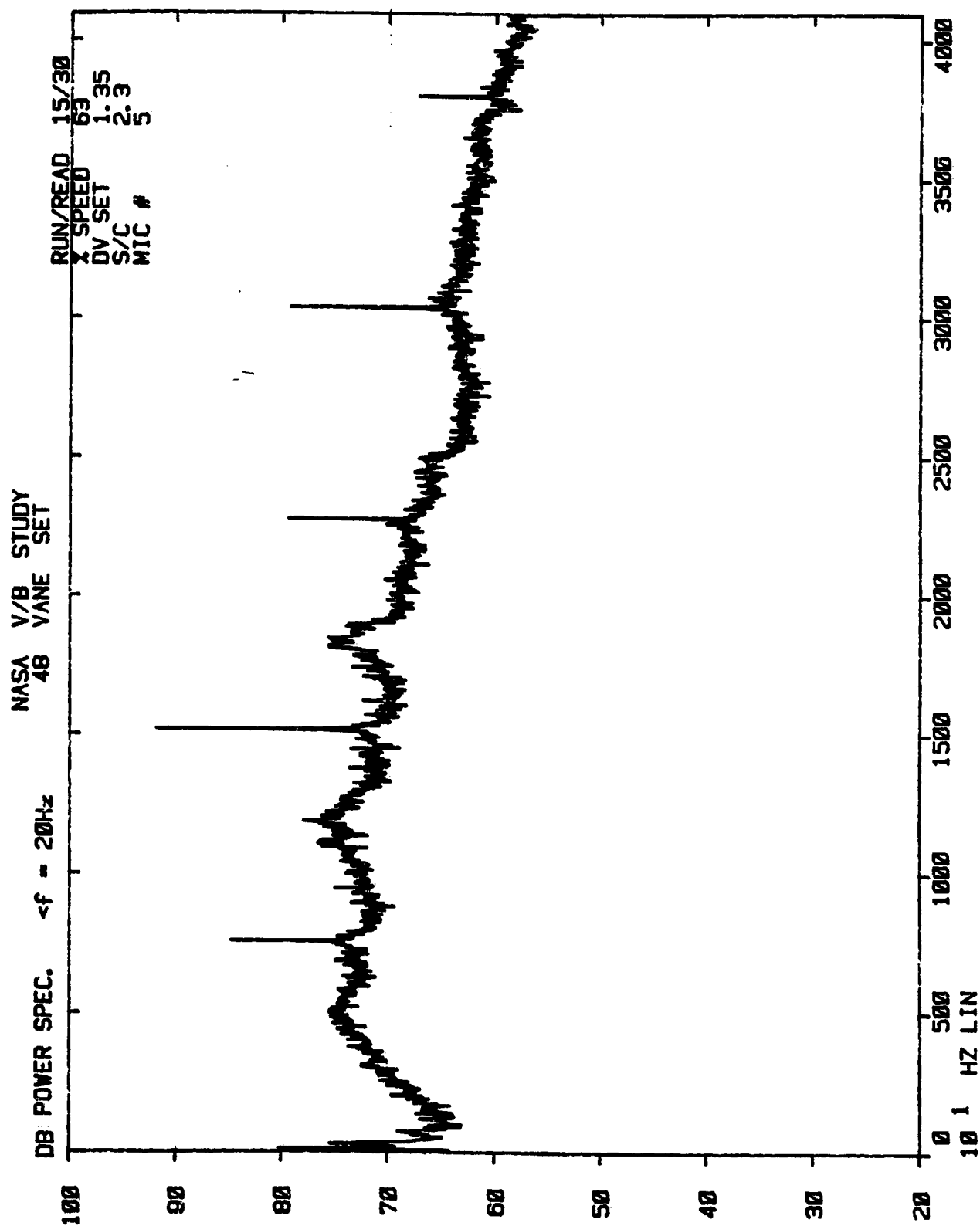


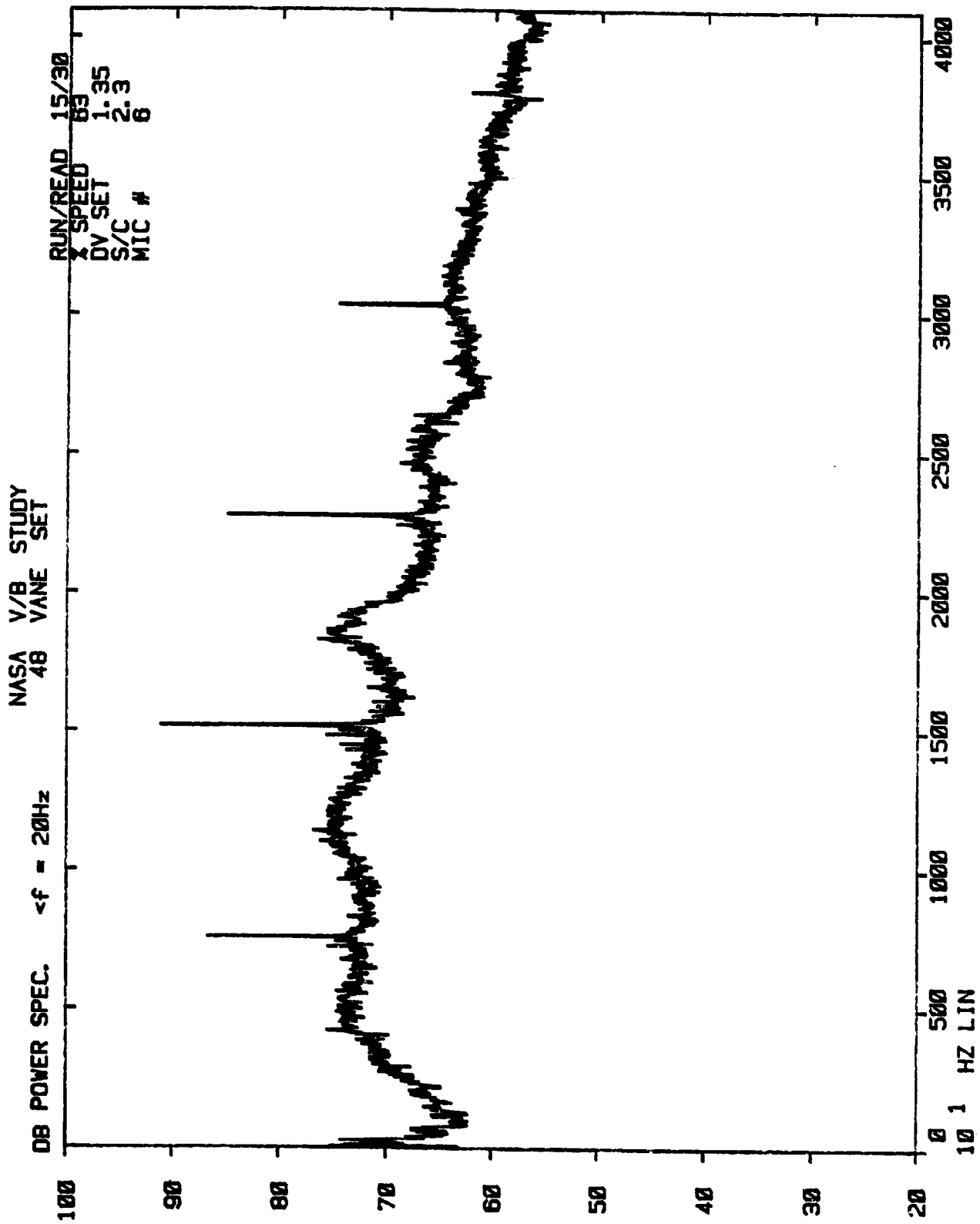


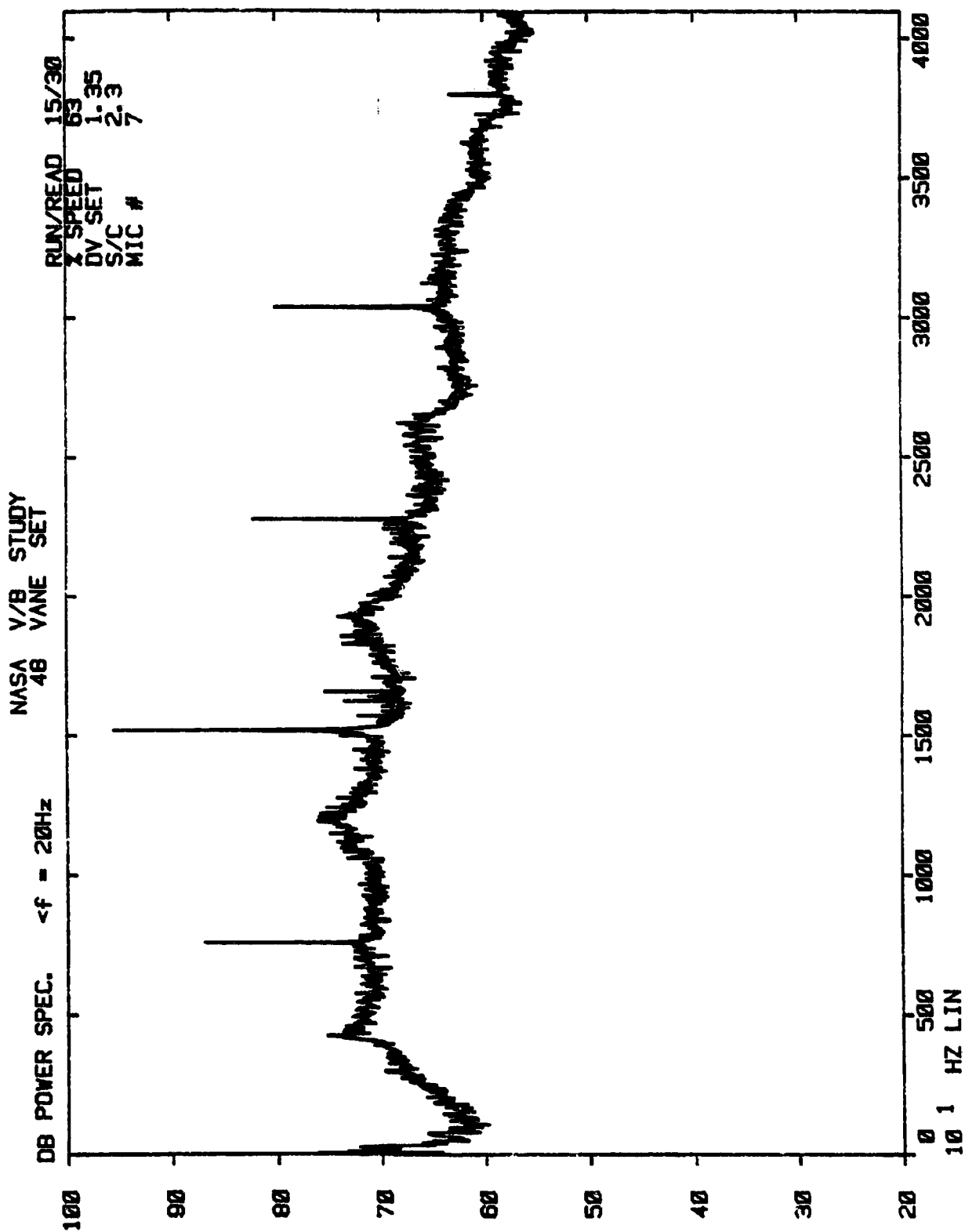


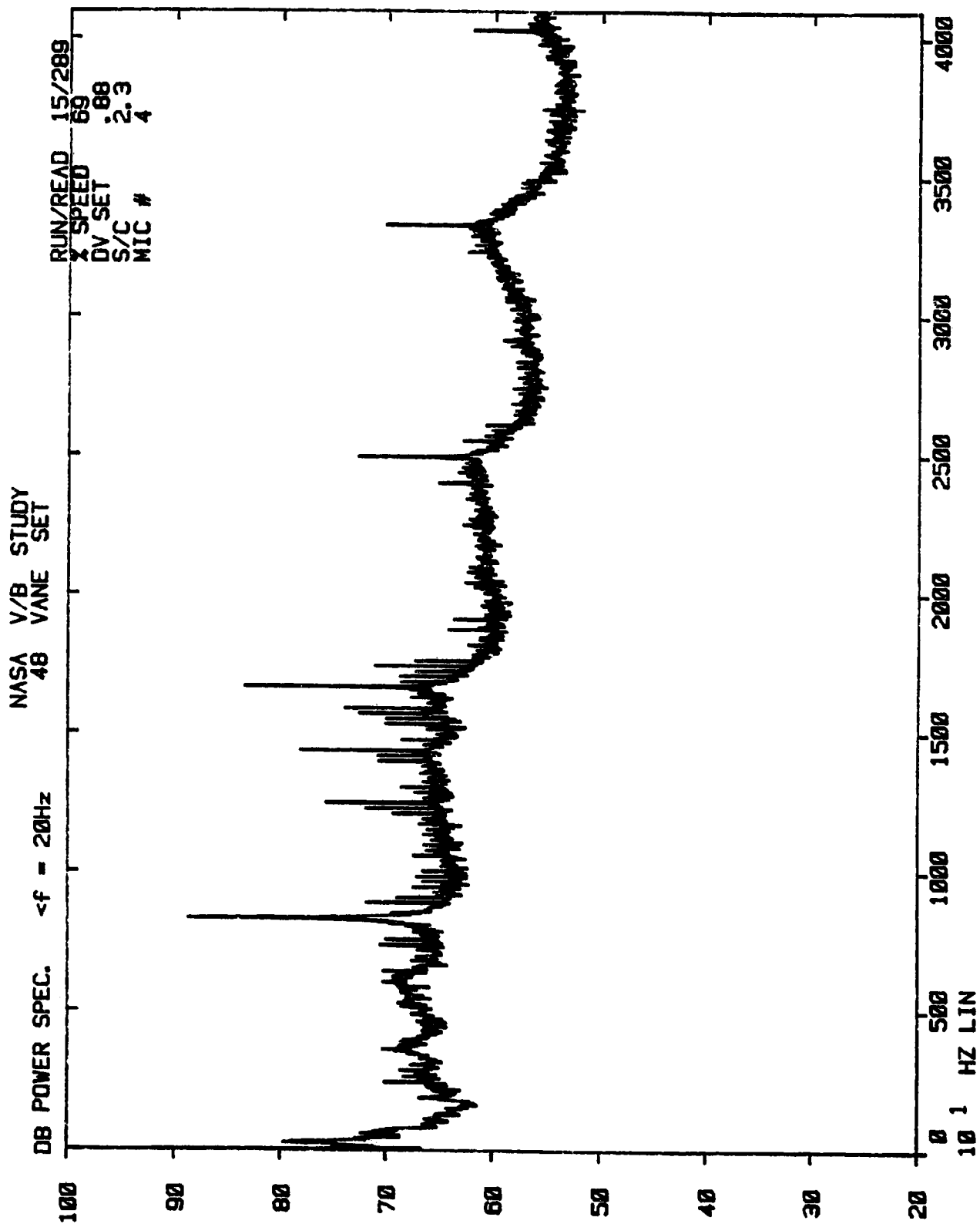












NASA V/B STUDY
48 VANE SET

DB POWER SPEC. $< f = 20\text{Hz}$

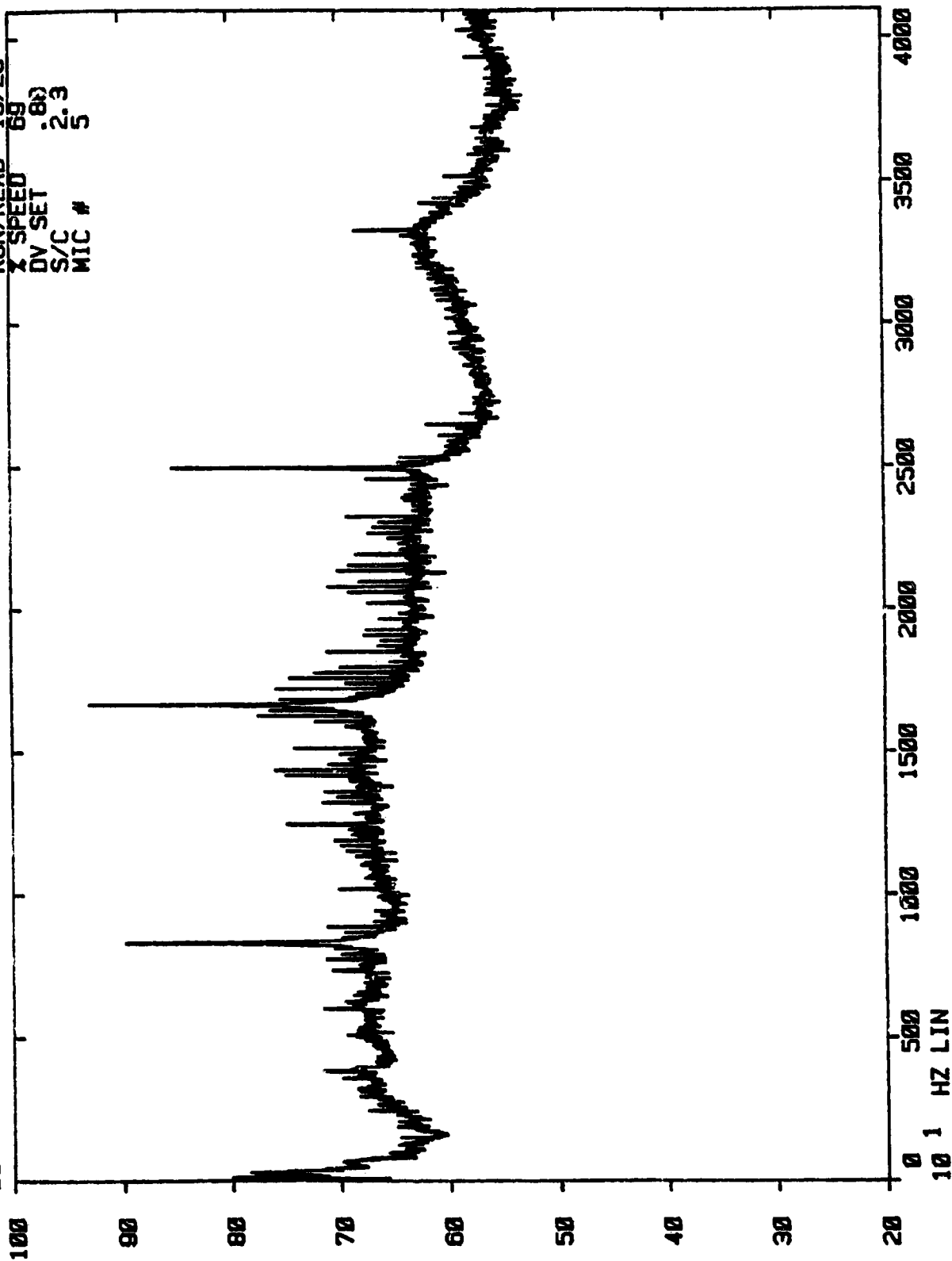
RUN/READ 15/28

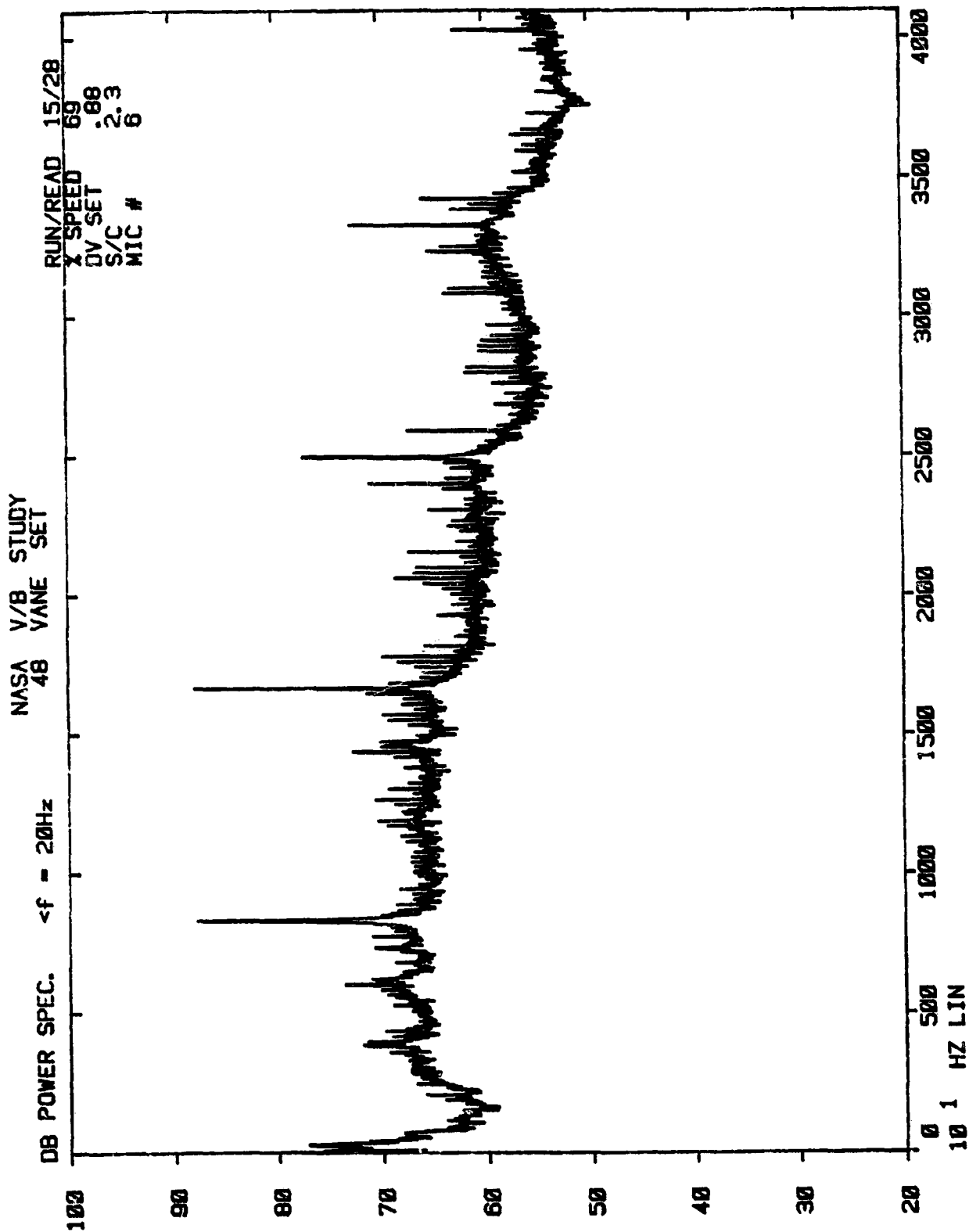
X SPEED 69

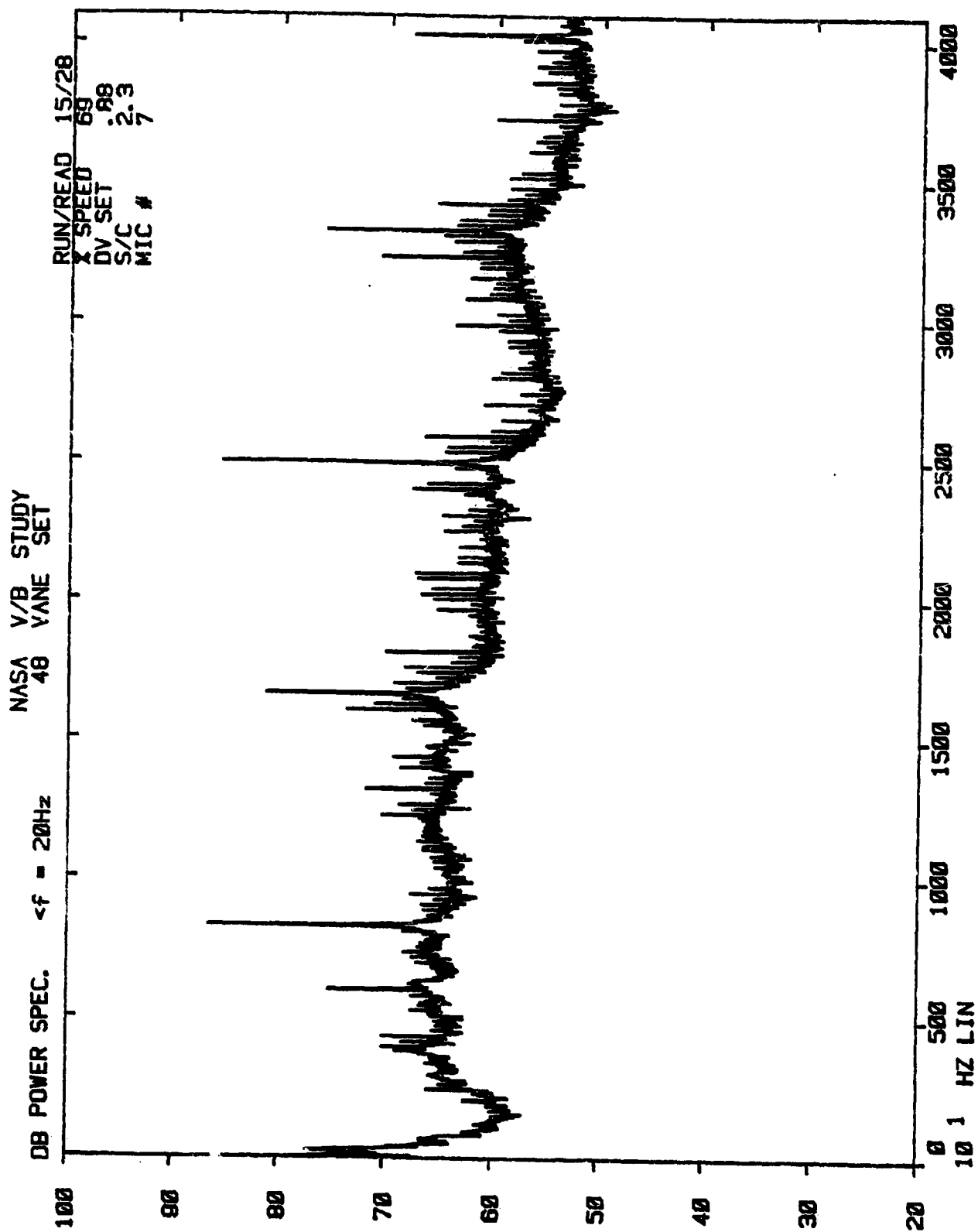
DV SET .83

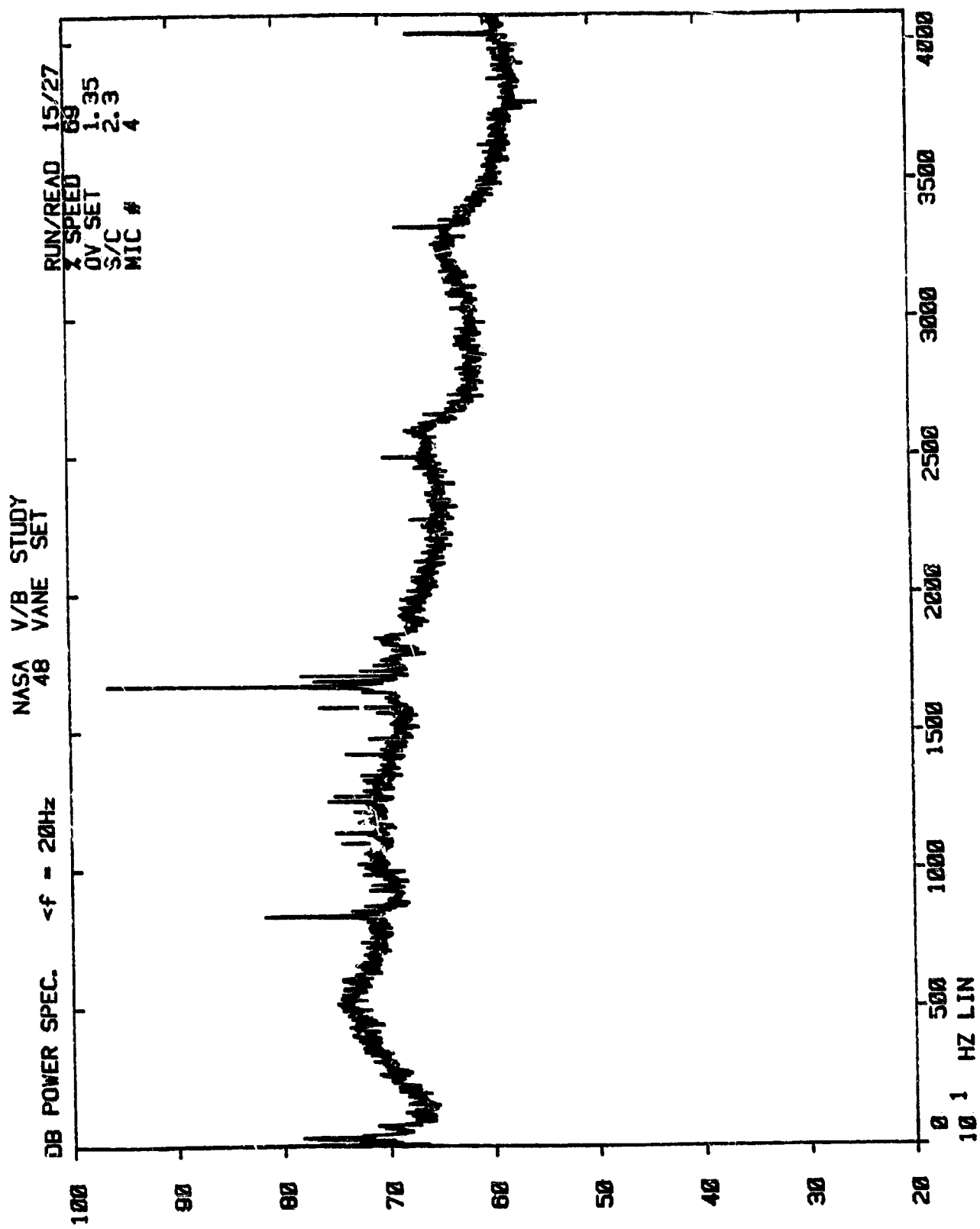
S/C 2.3

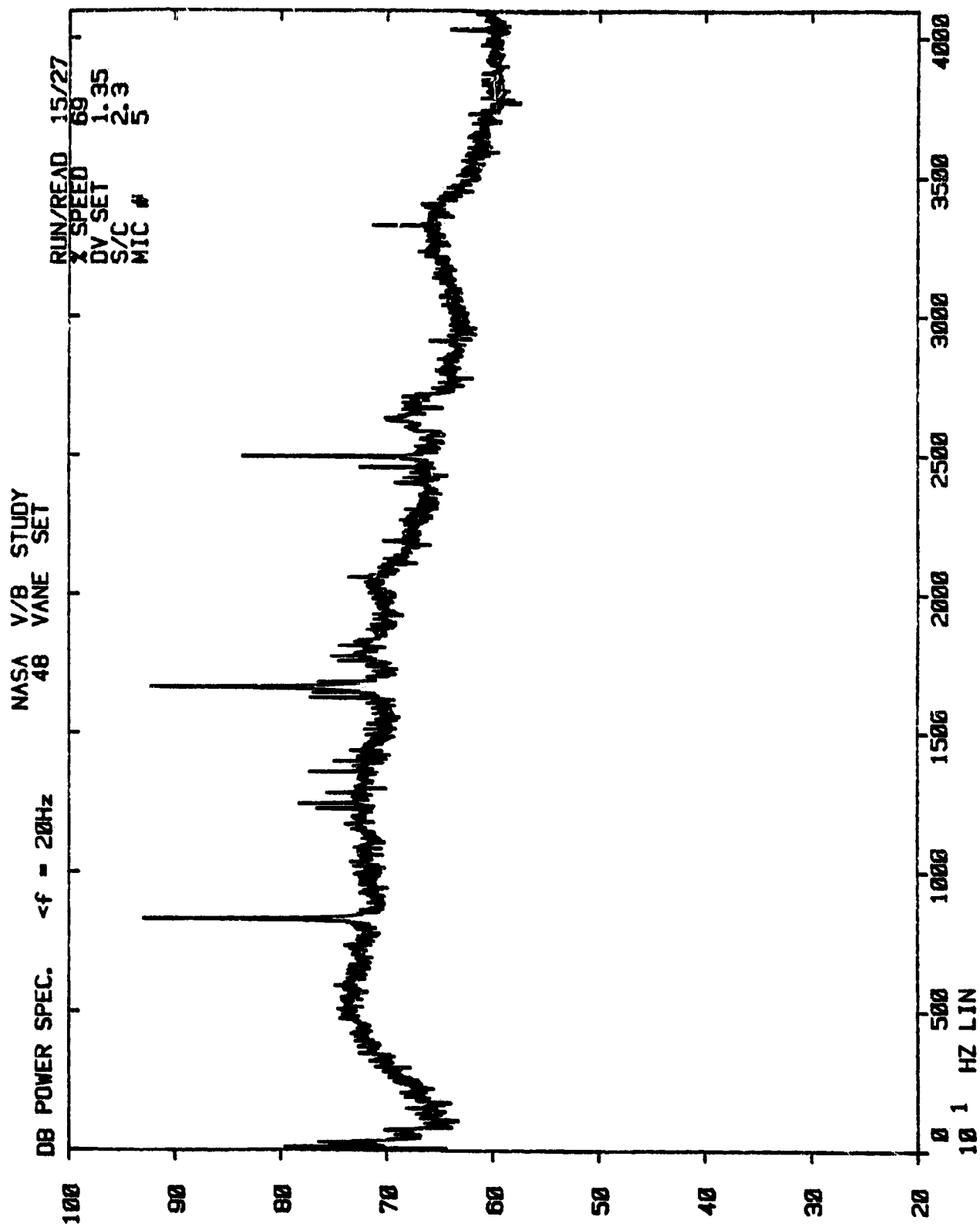
MIC # 5

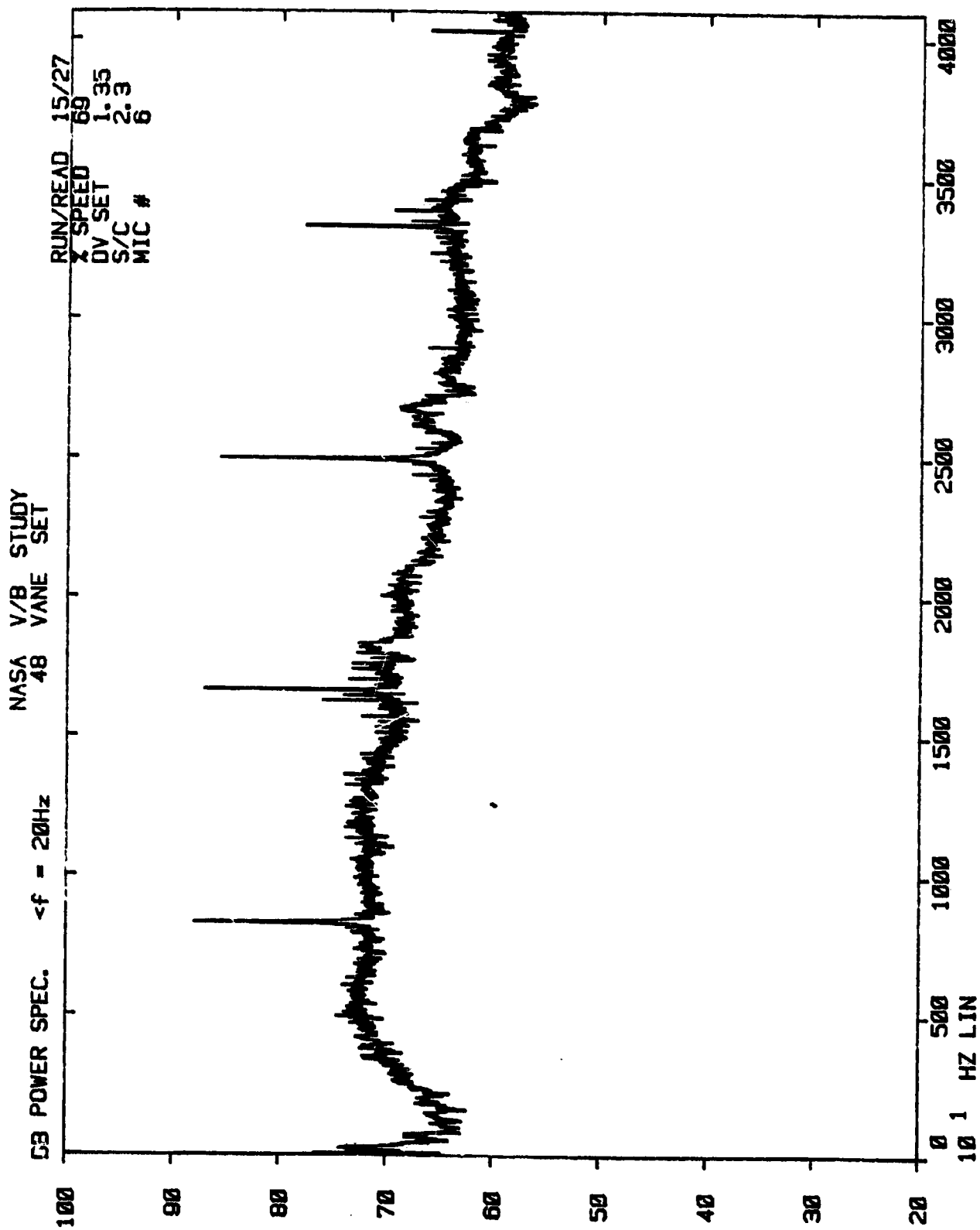








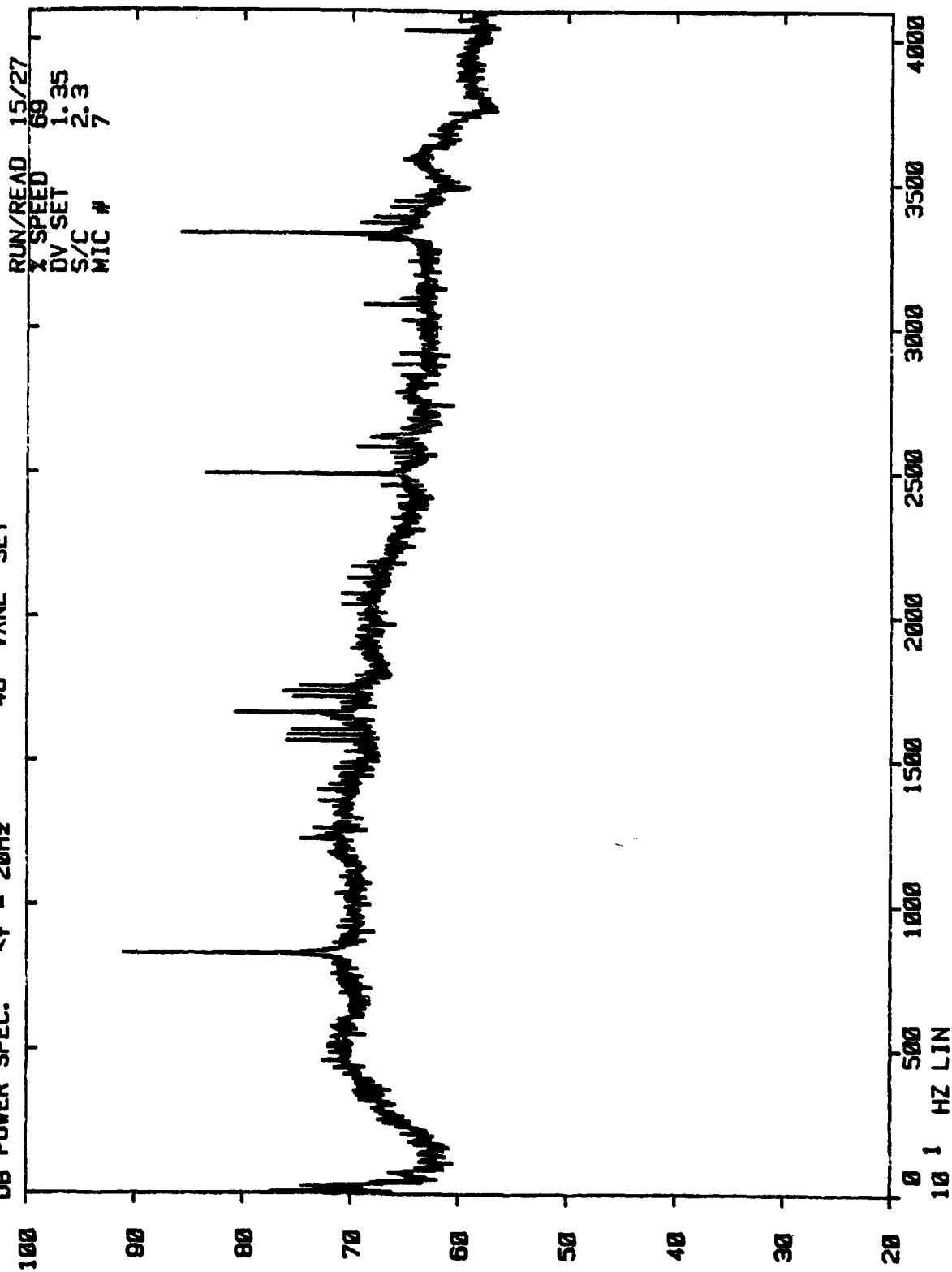


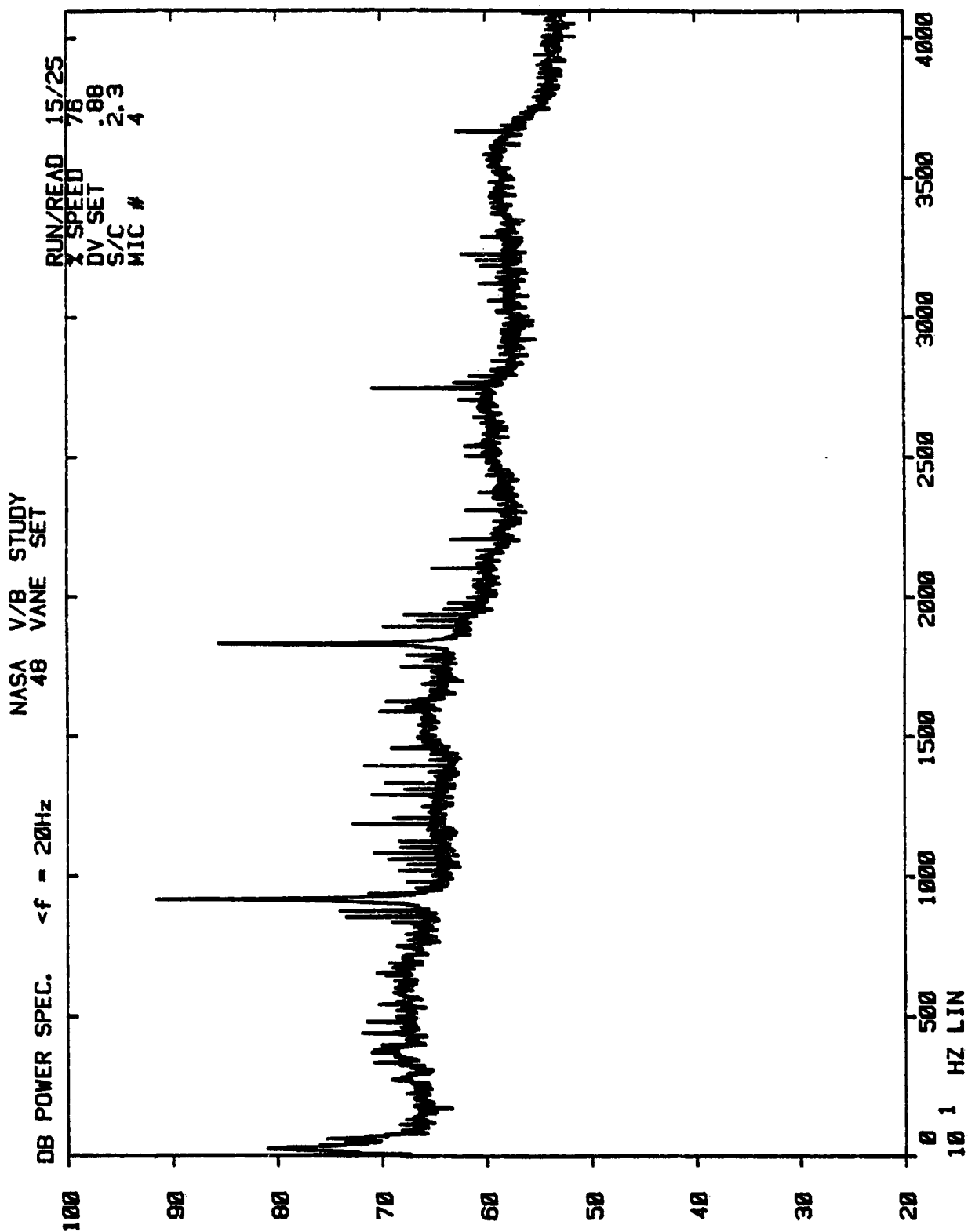


NASA V/B STUDY
48 VANE SET

<f = 20Hz

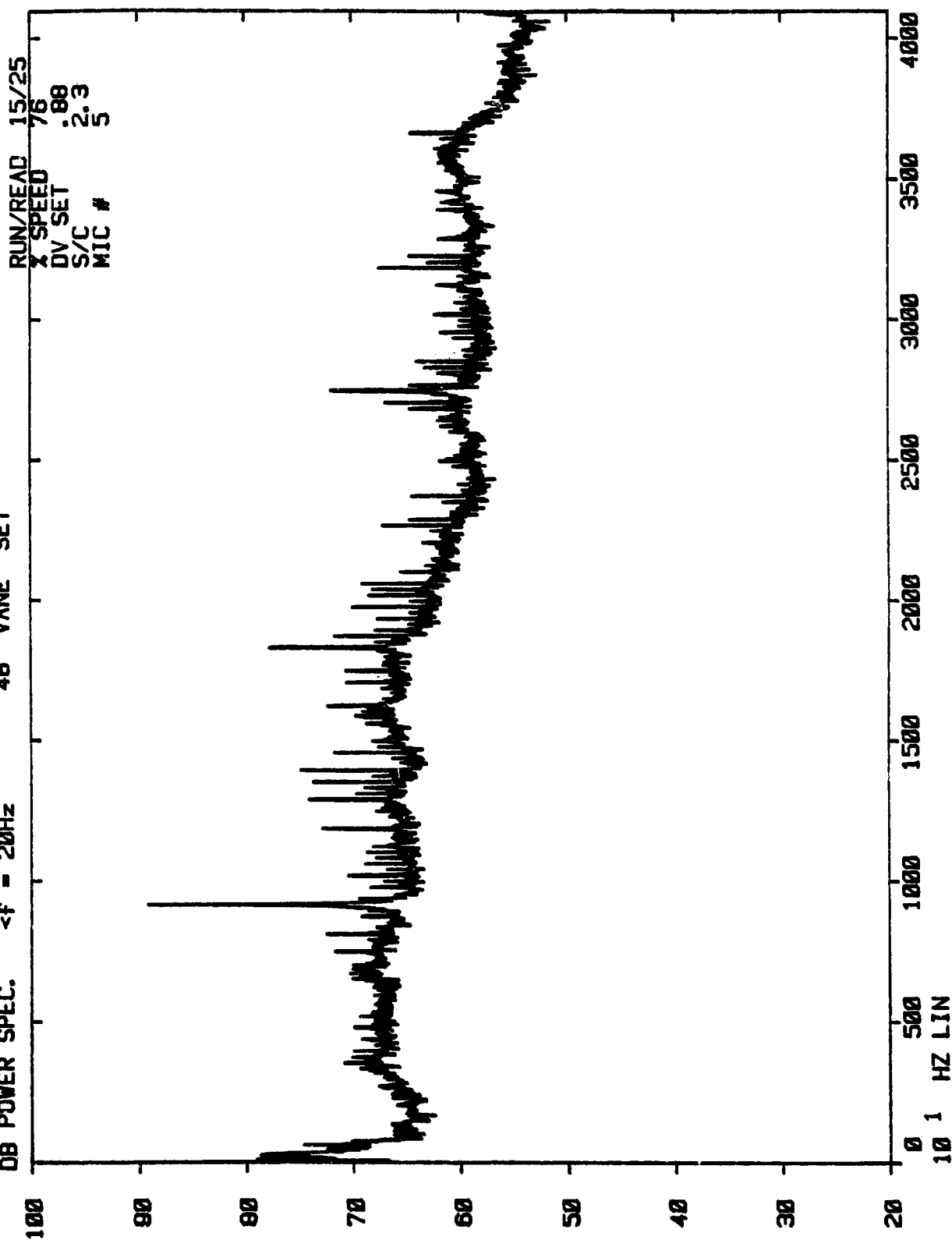
DB POWER SPEC.

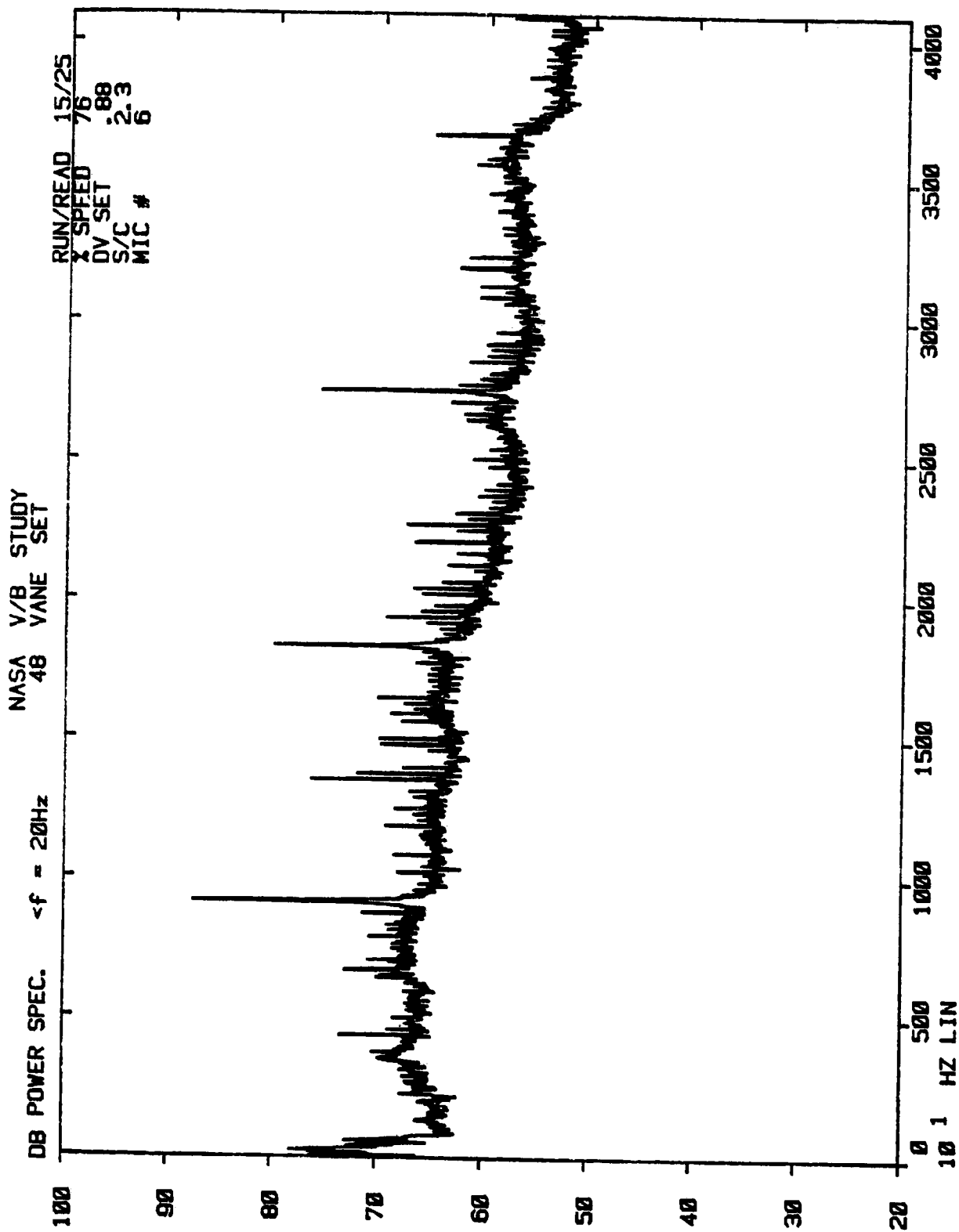




NASA V/B STUDY
4B VANE SET

DB POWER SPEC. <f = 20Hz





NASA V/B STUDY
48 VANE SET

DB POWER SPEC. $\Delta f = 20\text{Hz}$

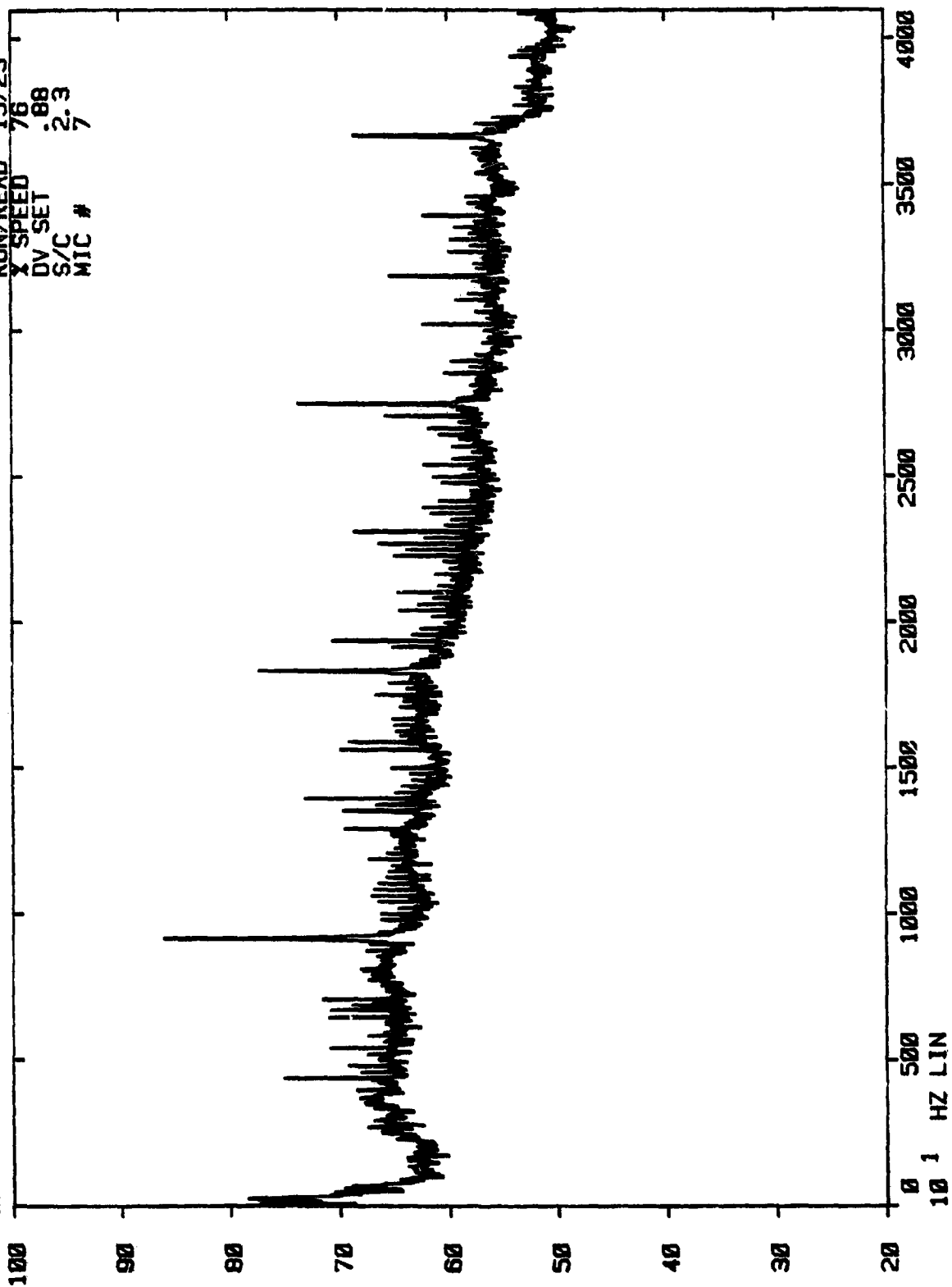
RUN/READ 15/25

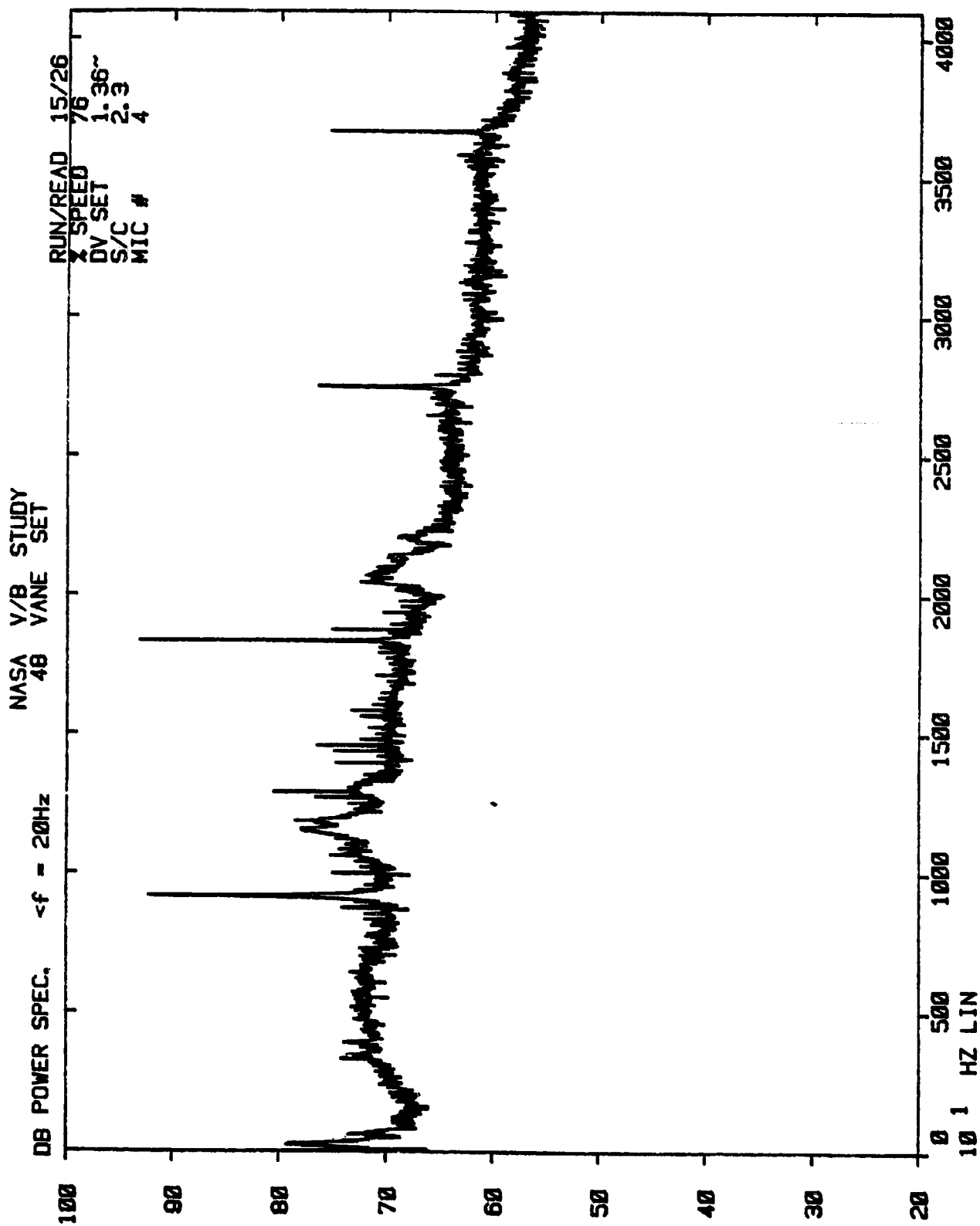
X SPEED 76

DV SET .88

S/C 2.3

MIC # 7





NASA V/B STUDY
48 VANE SET

<f = 20Hz

DB POWER SPEC.

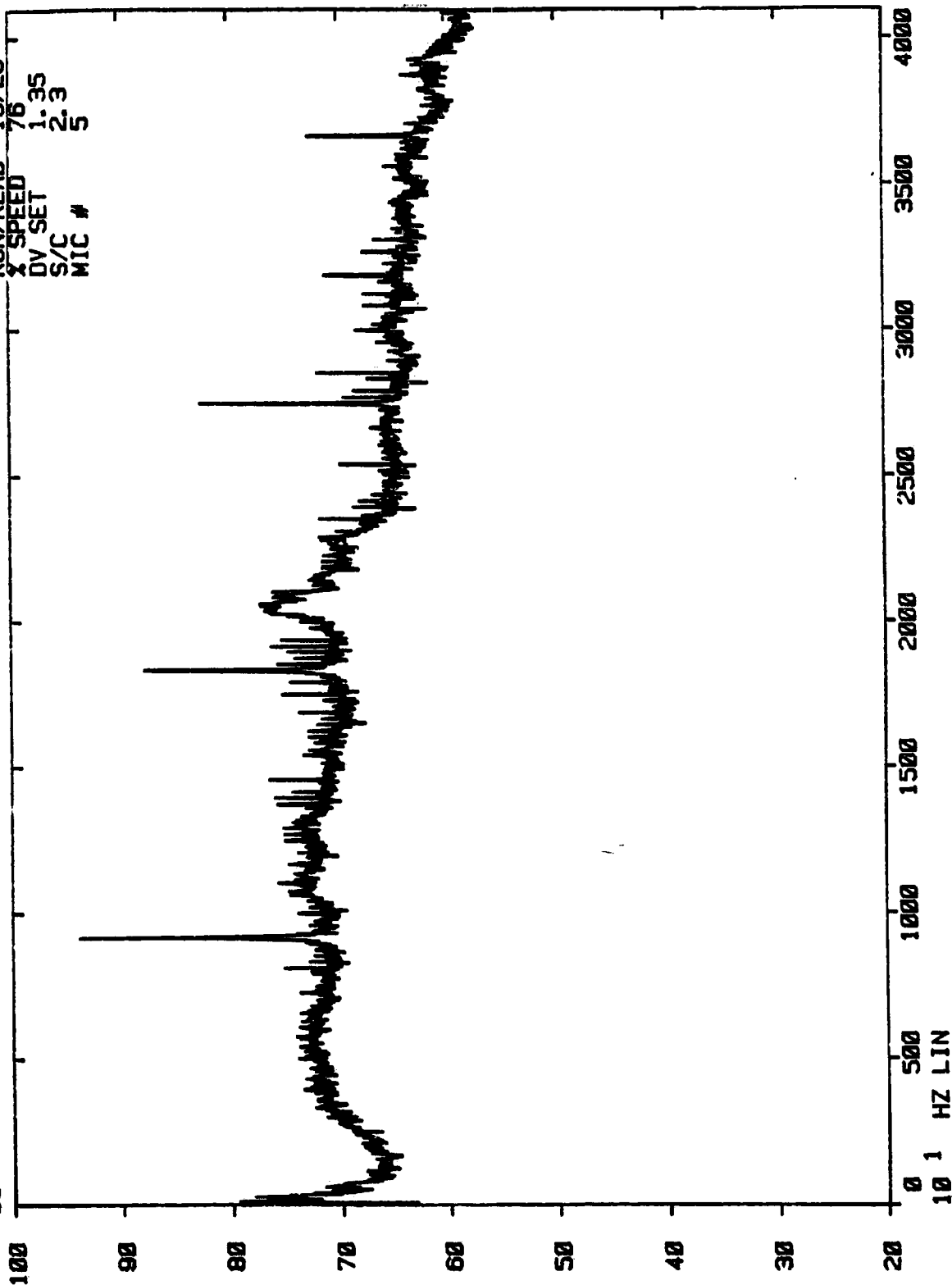
RUN/READ 15/26

X SPEED 76

DV SET 1.35

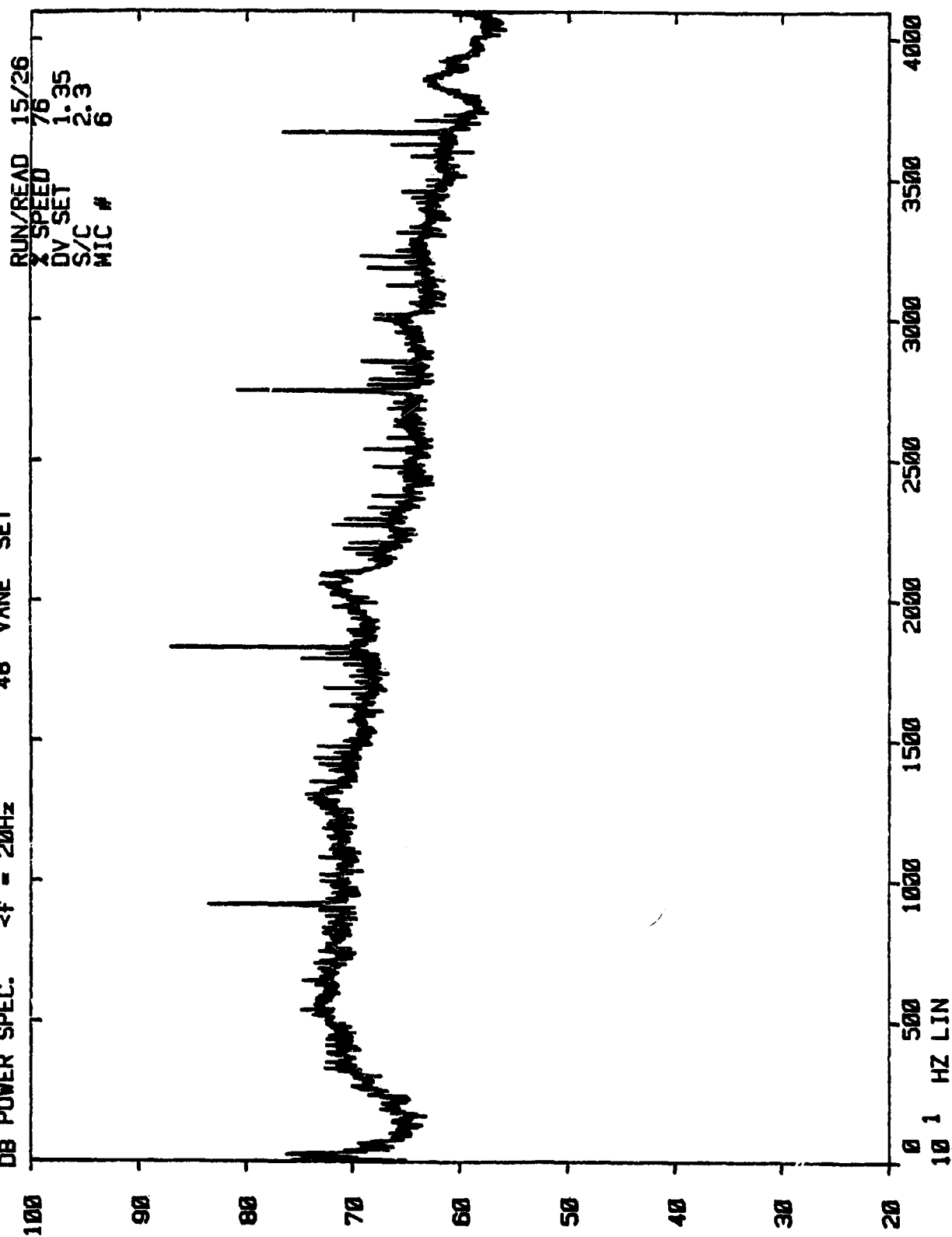
S/C 2.3

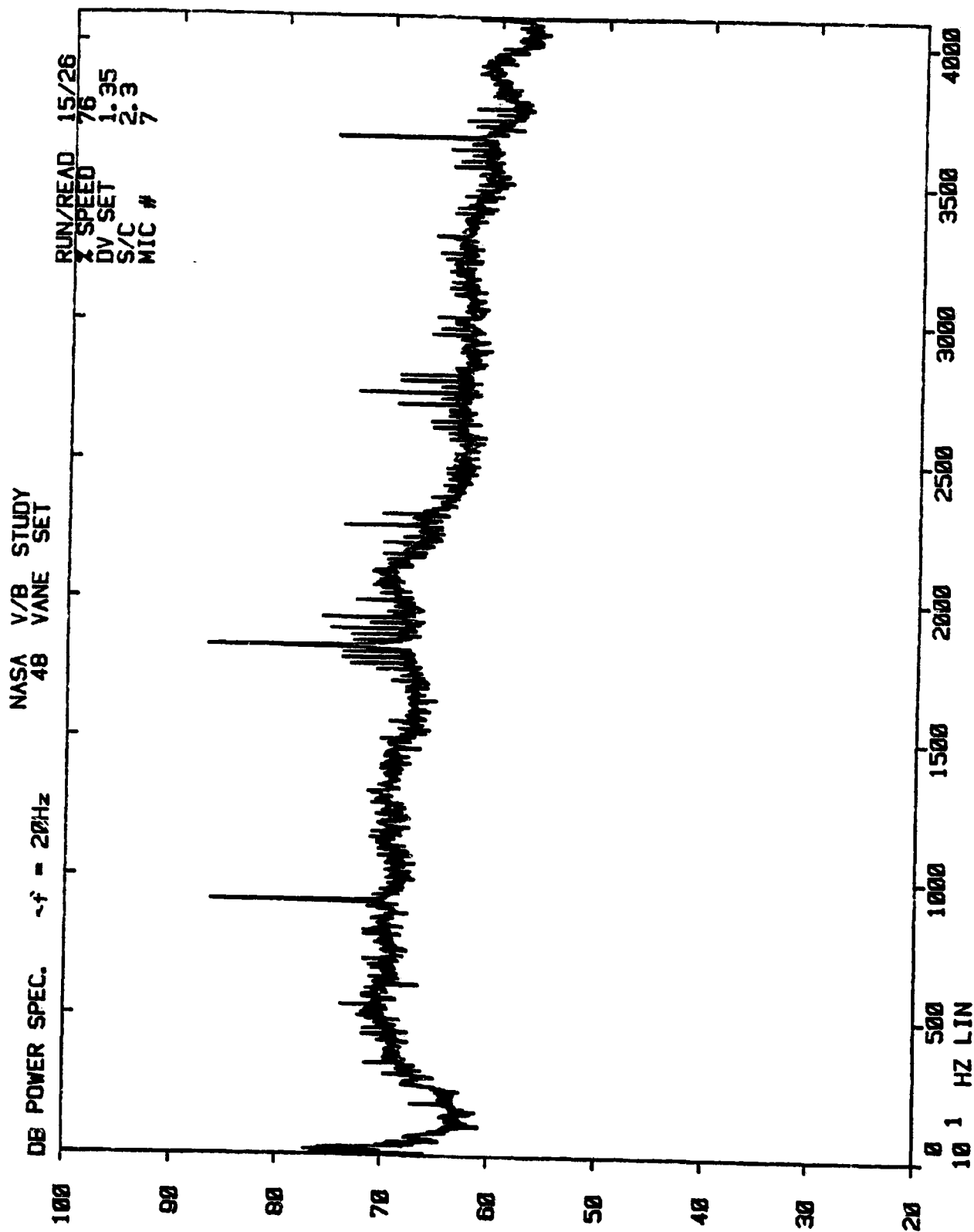
MIC # 5

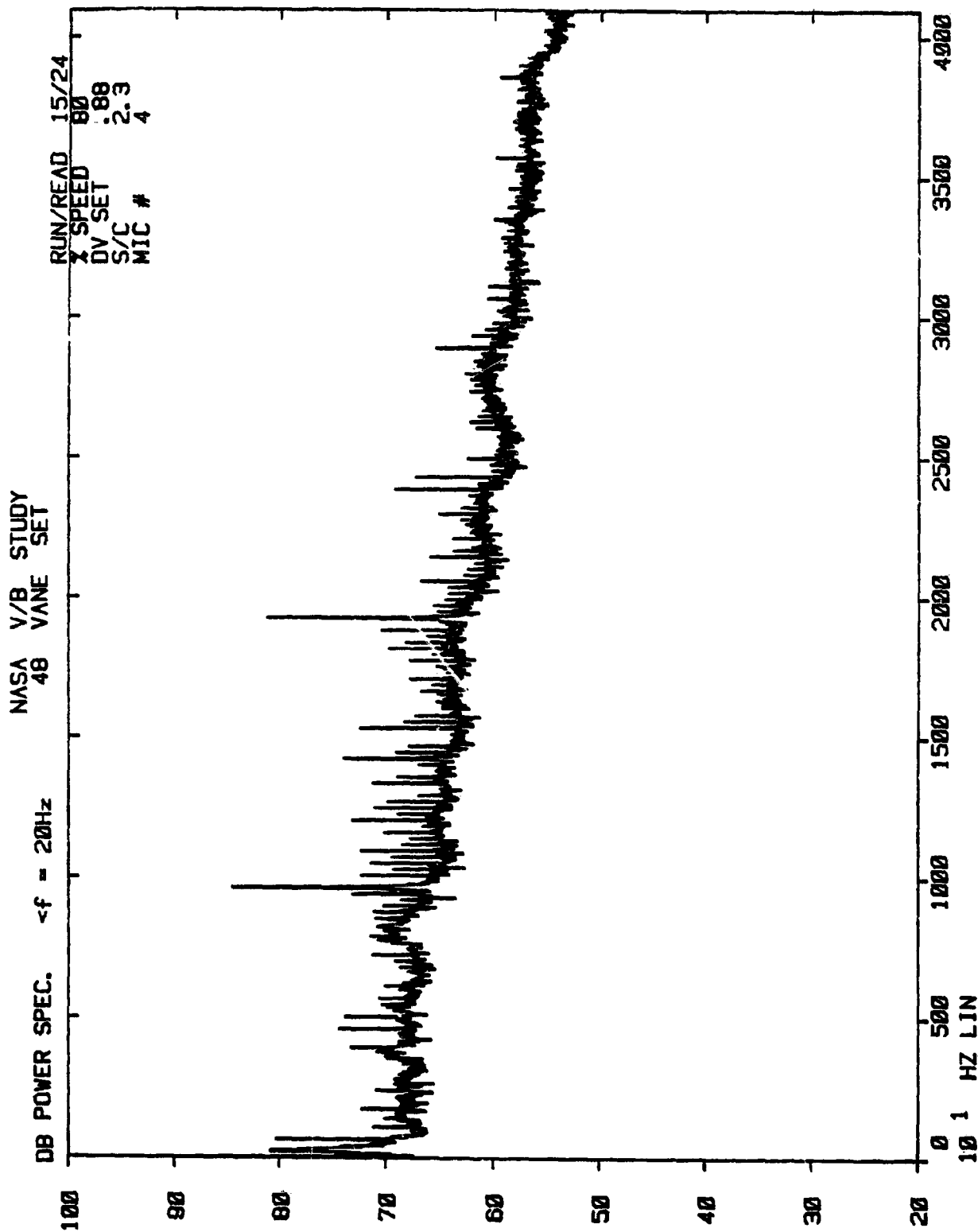


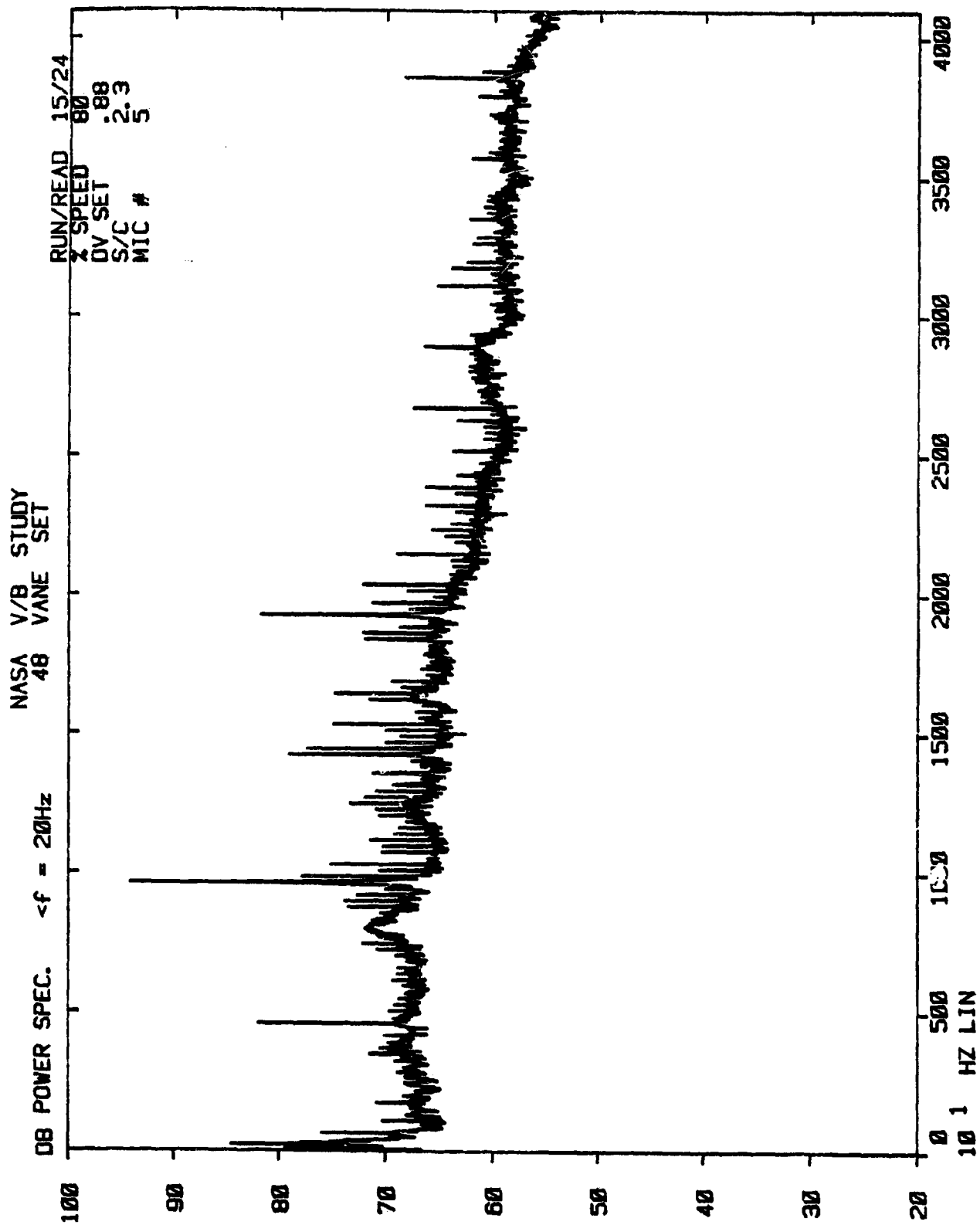
NASA V/B STUDY
48 VANE SET

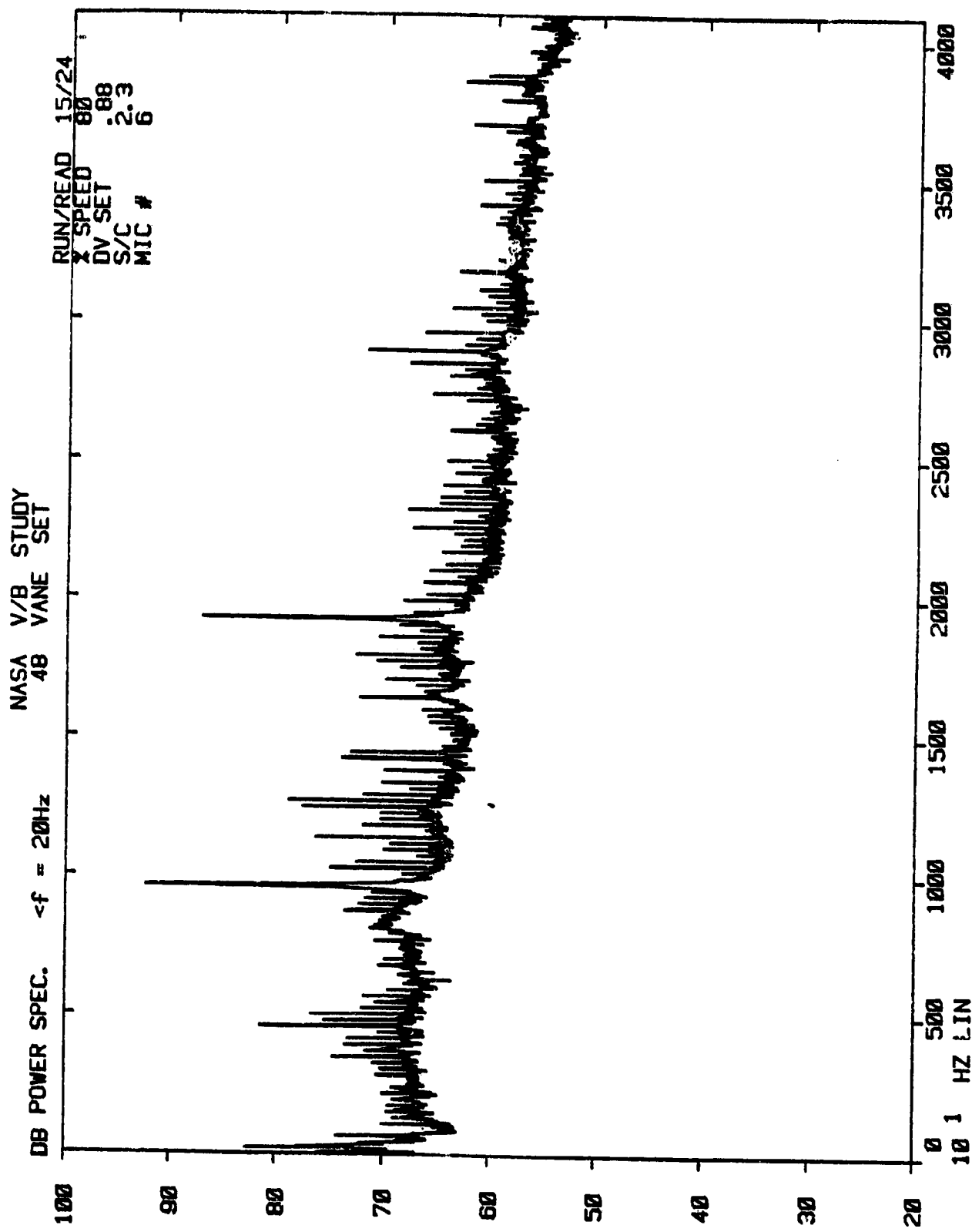
DB POWER SPEC. $< f = 20\text{Hz}$

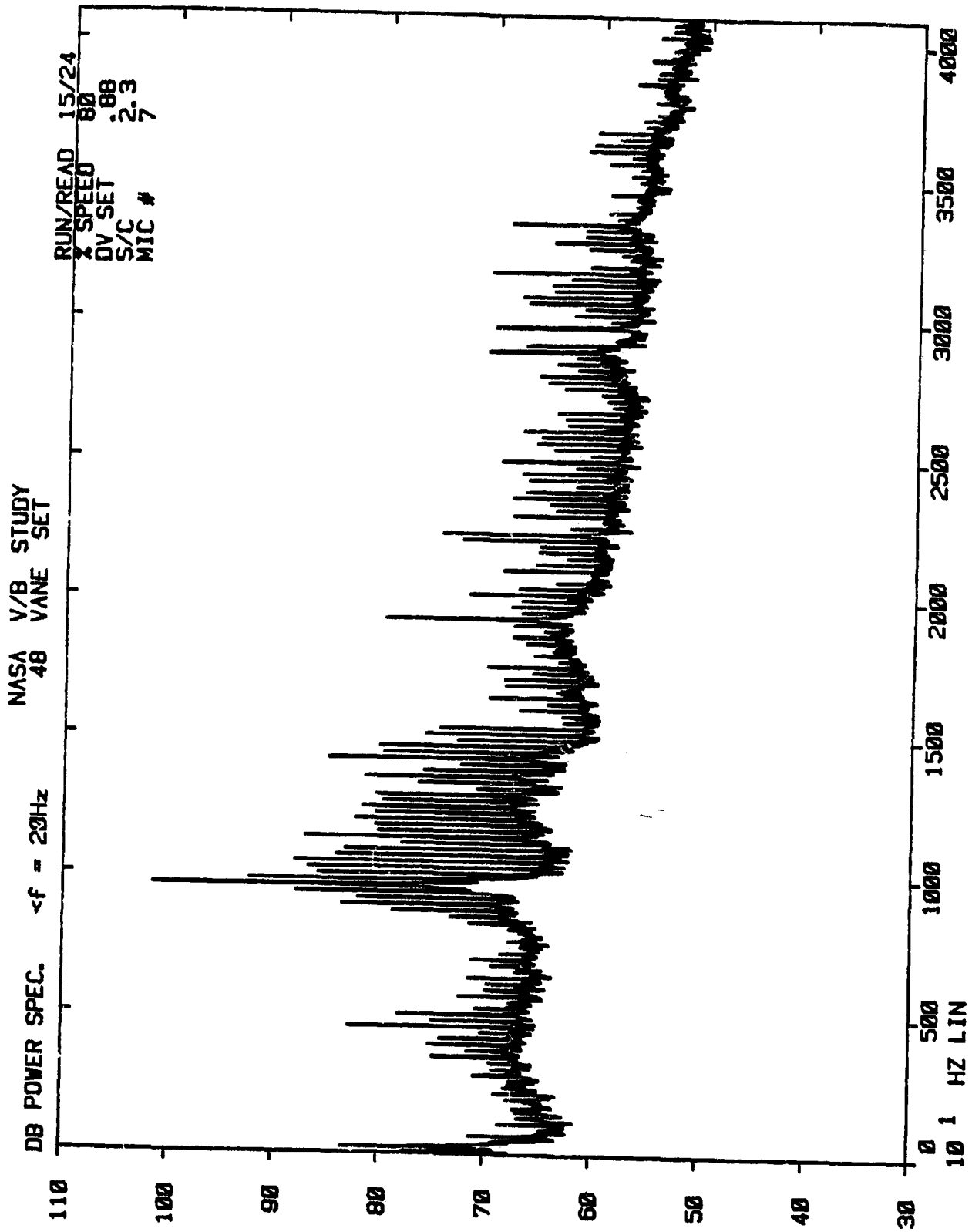


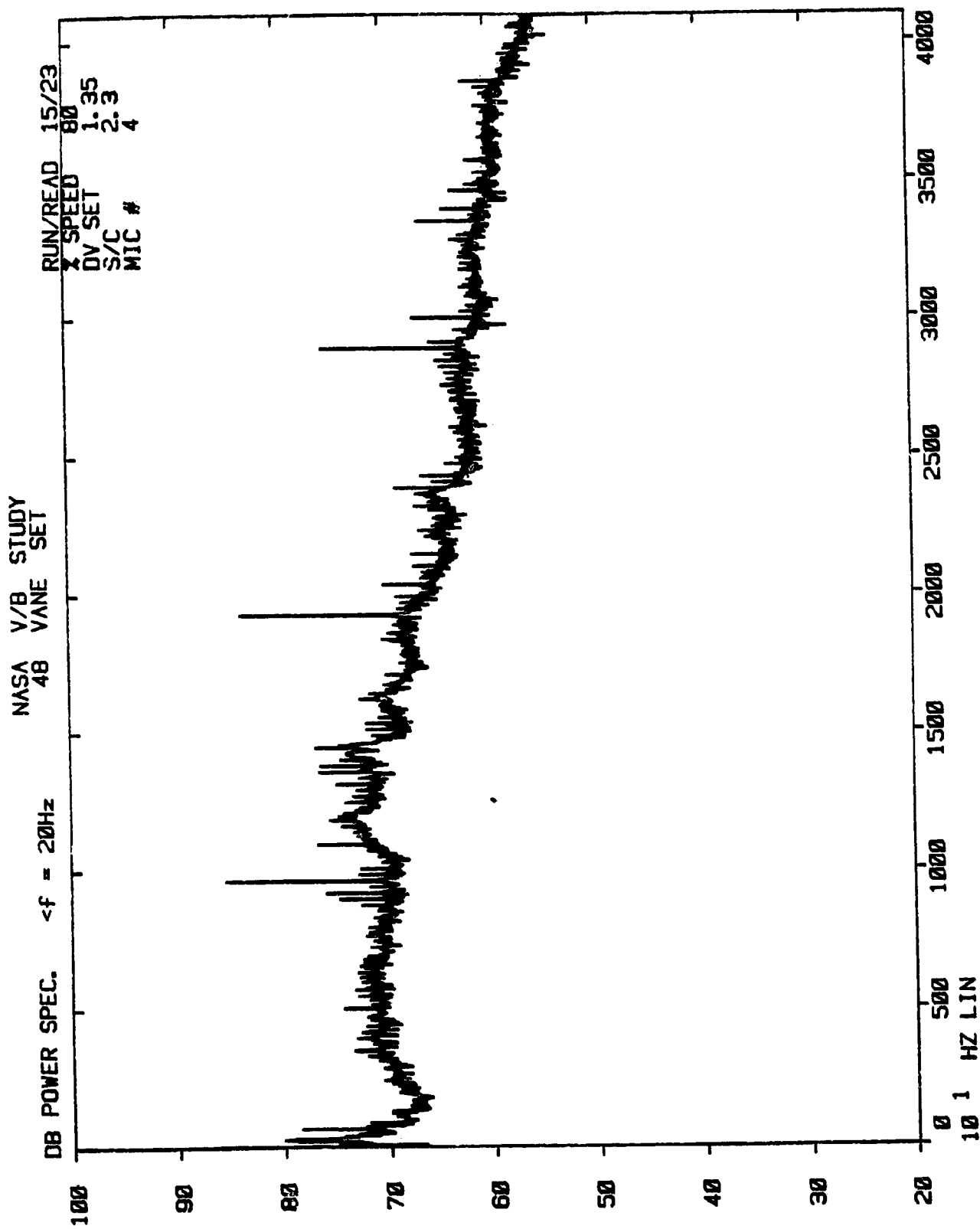


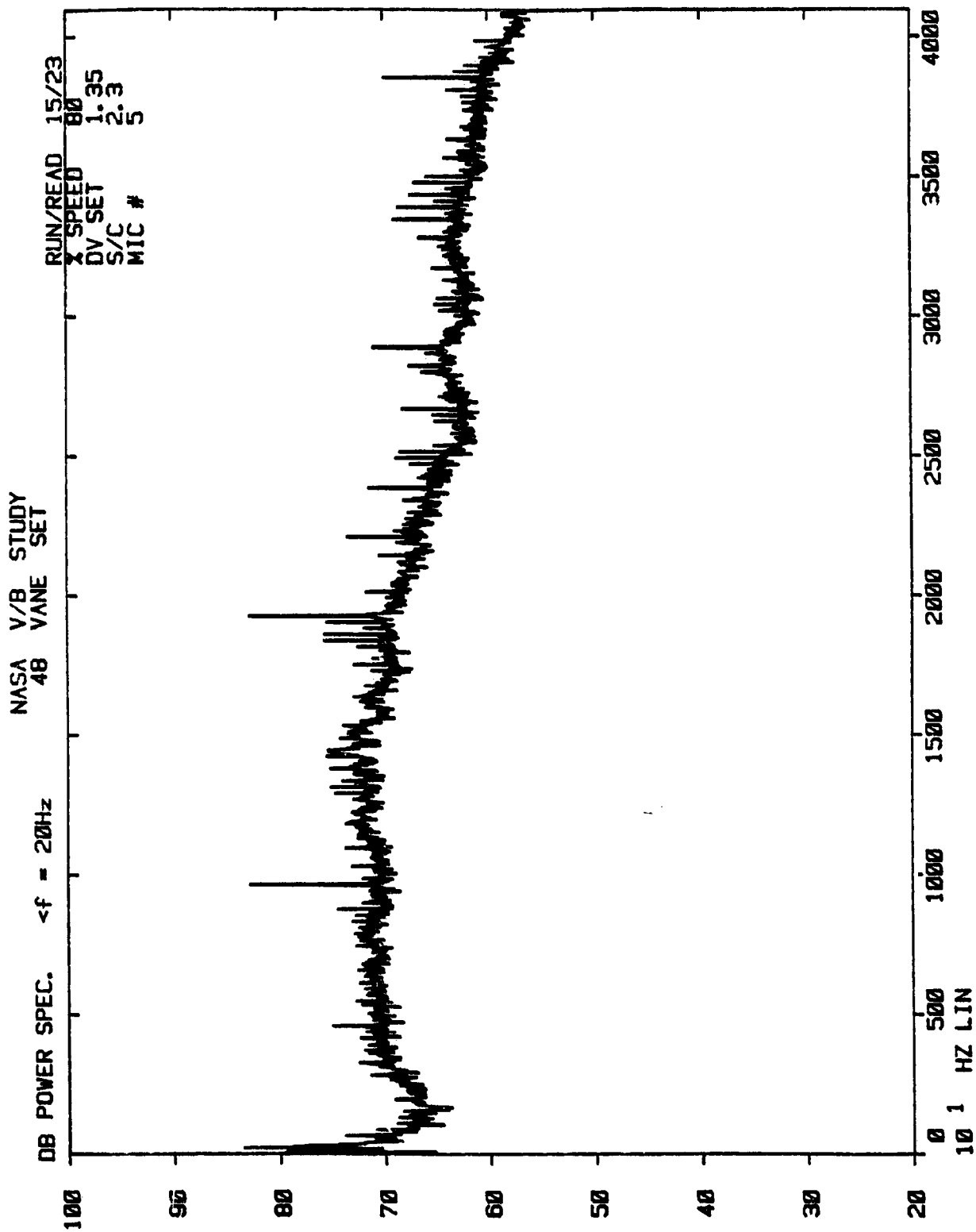


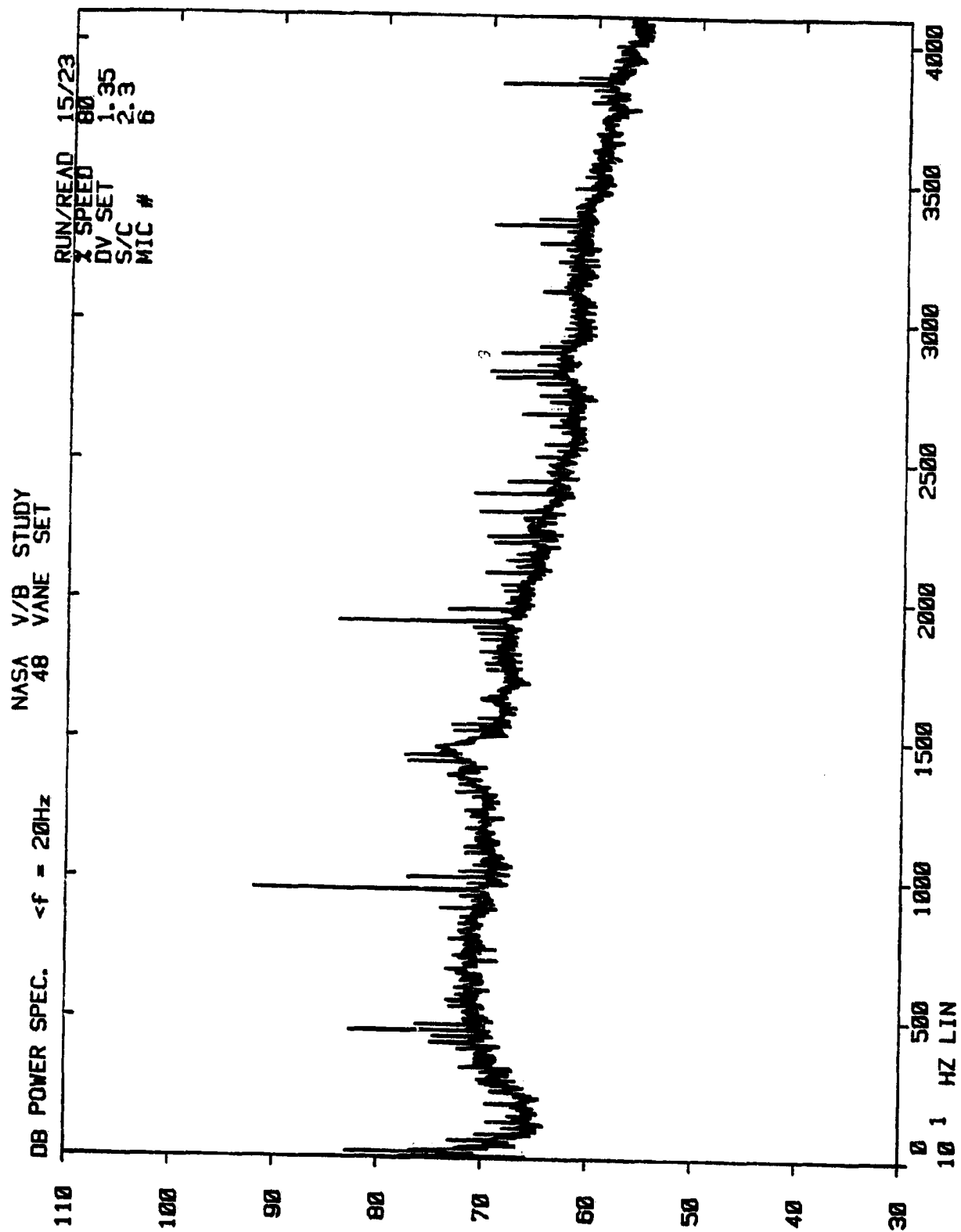


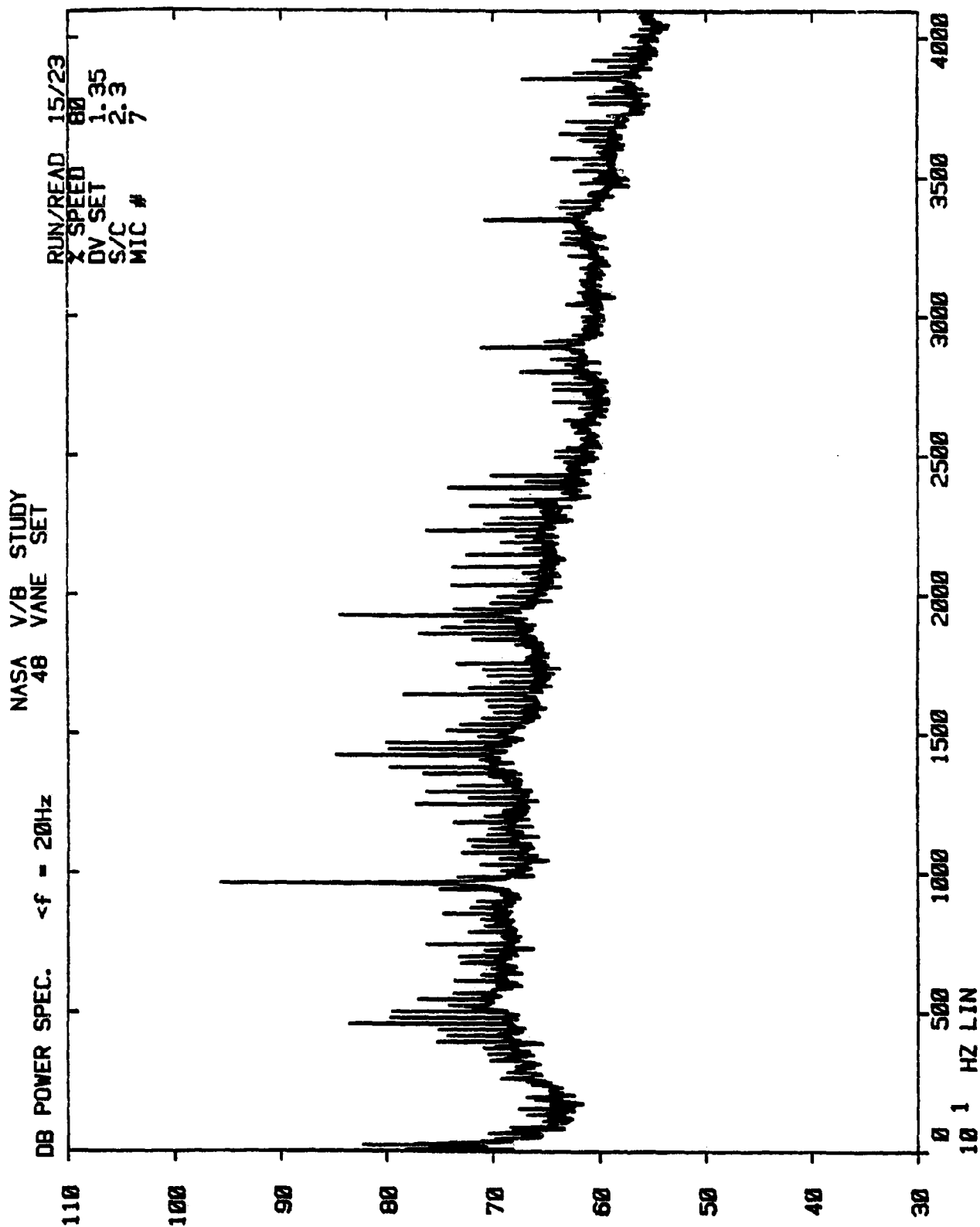


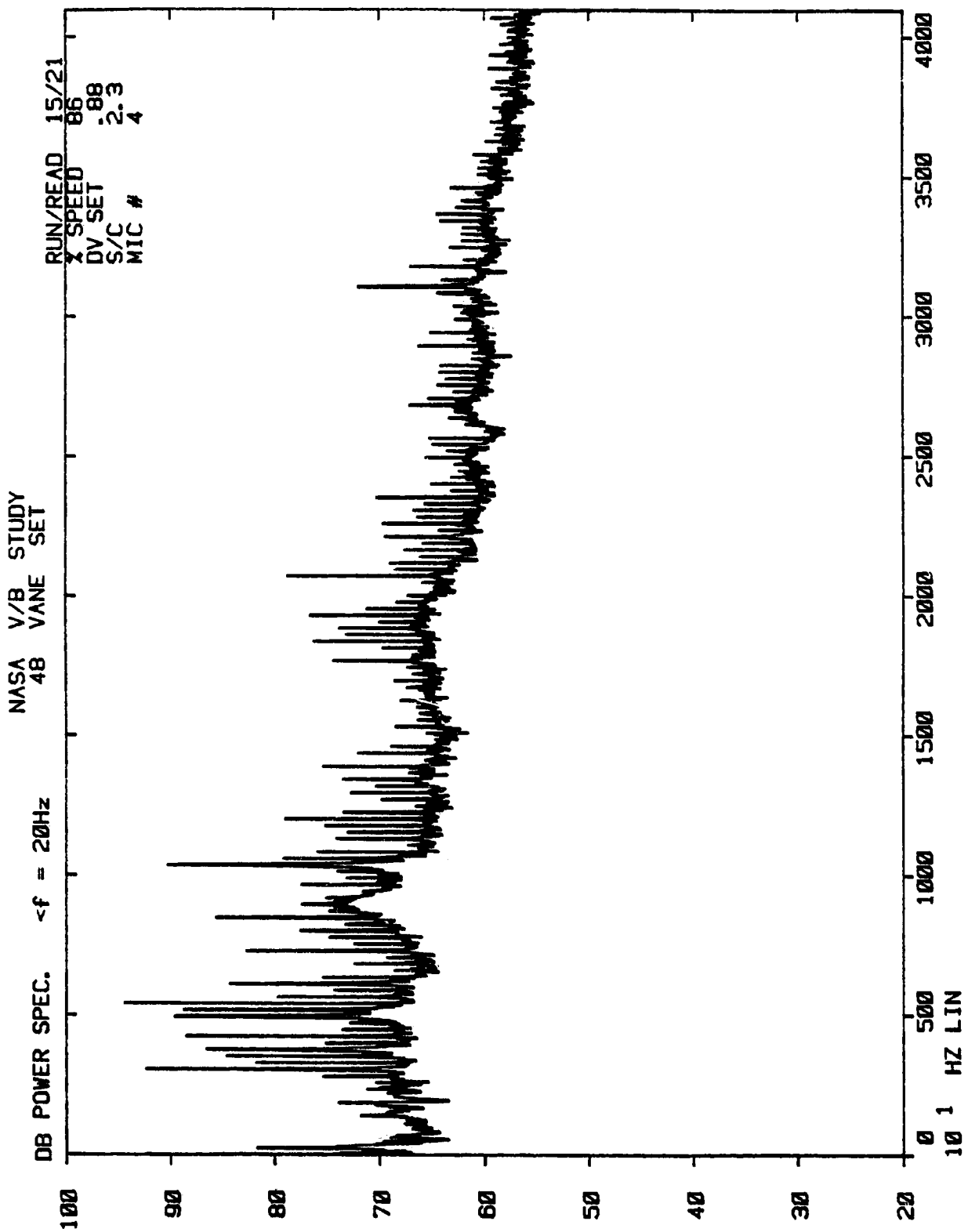


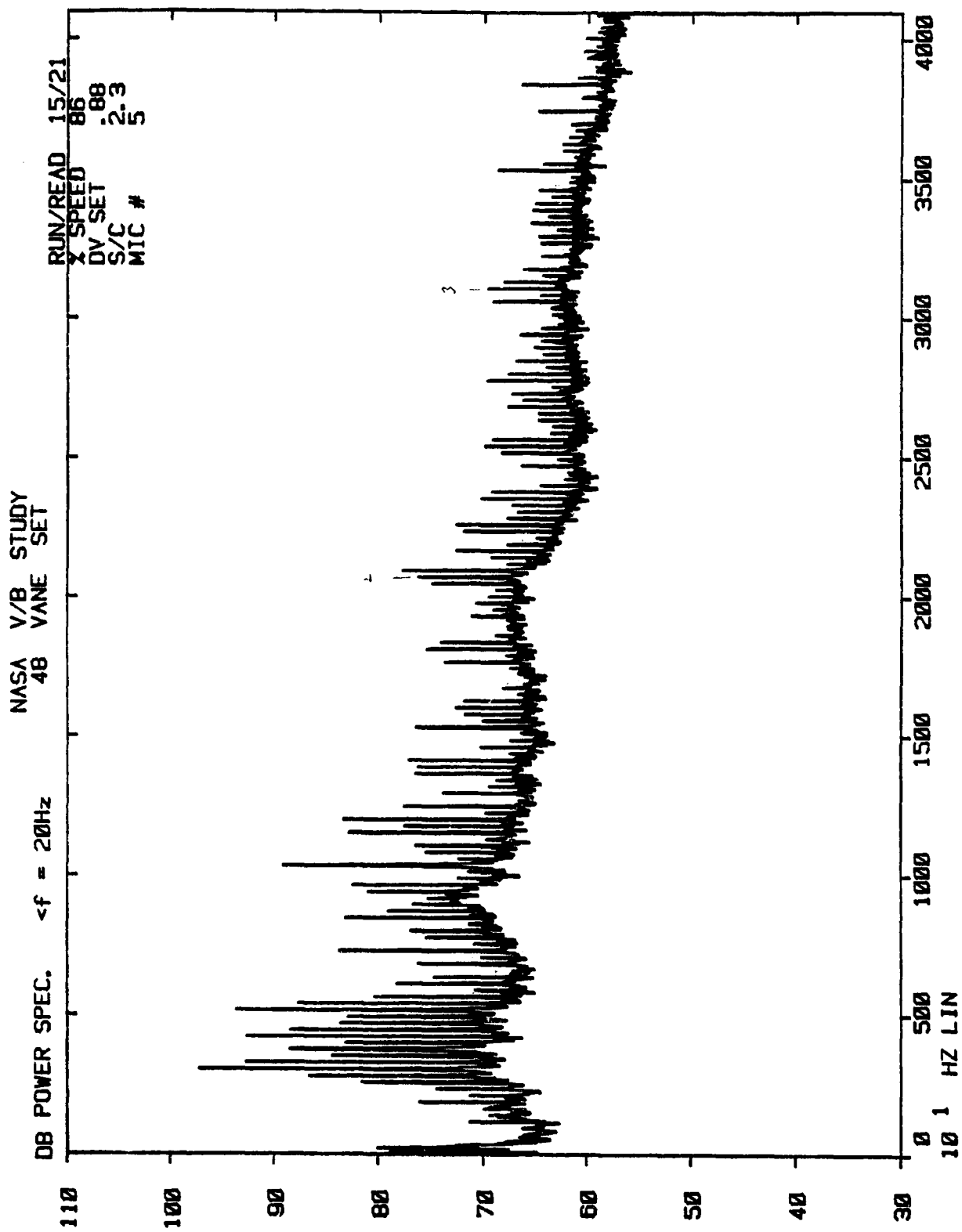


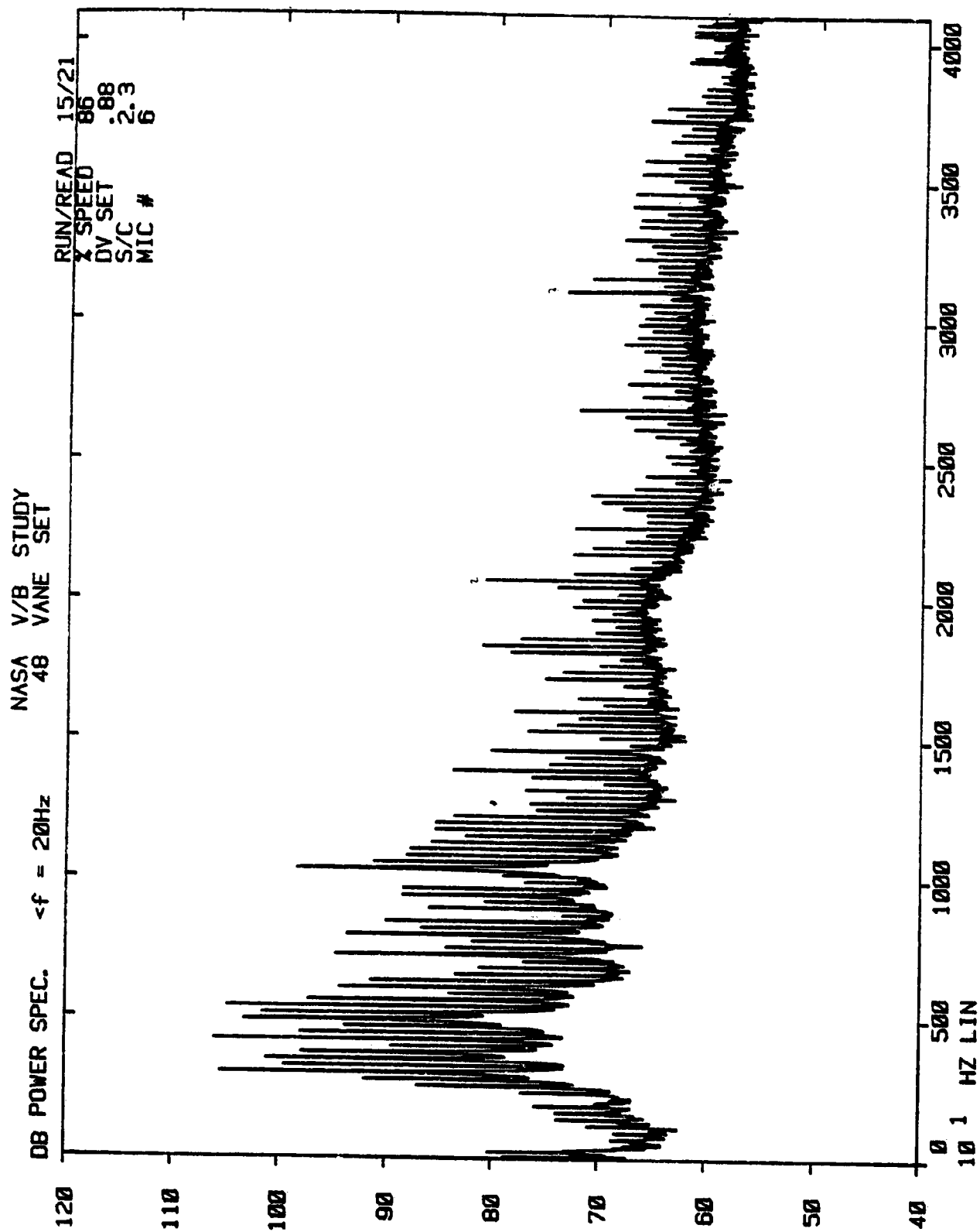


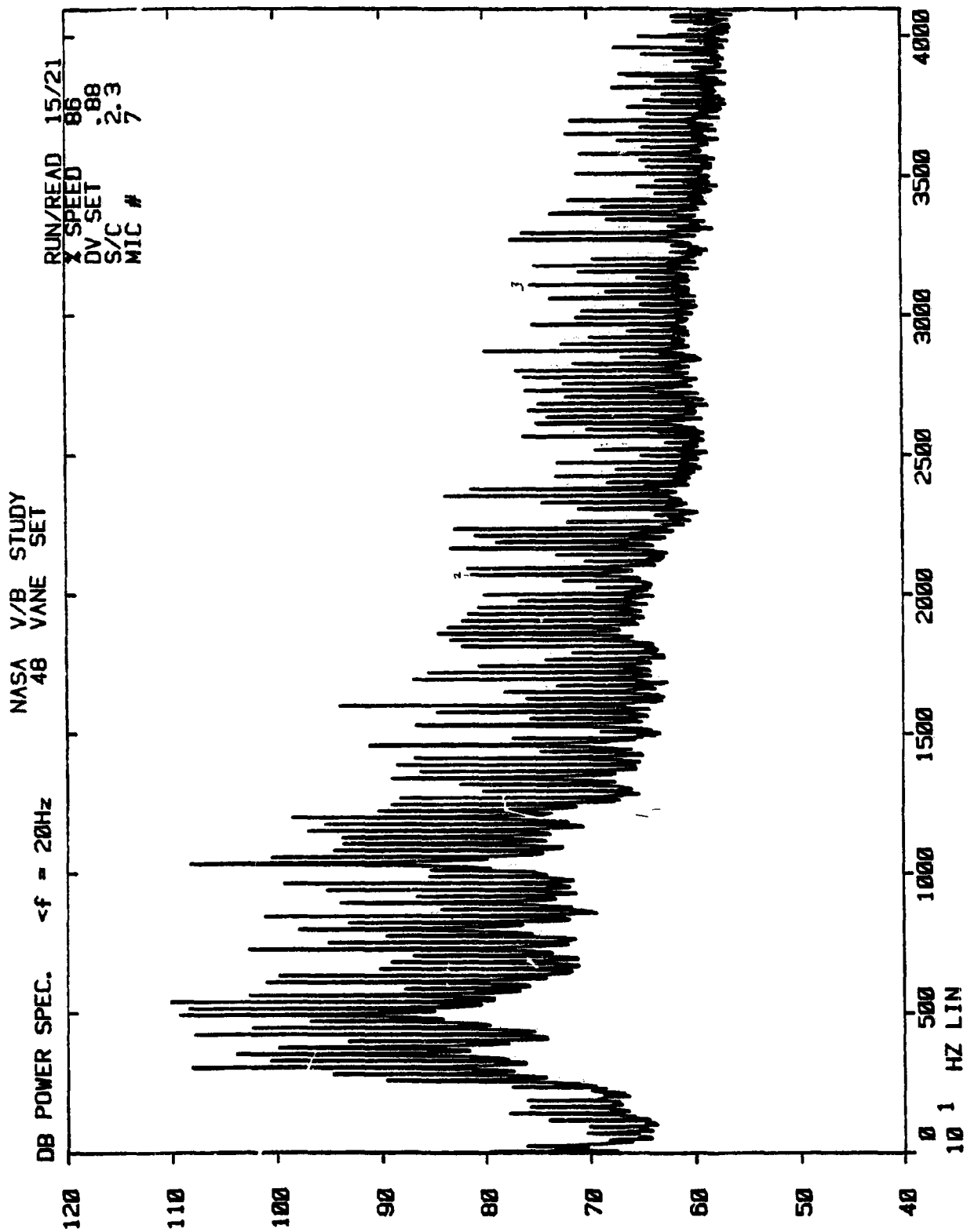


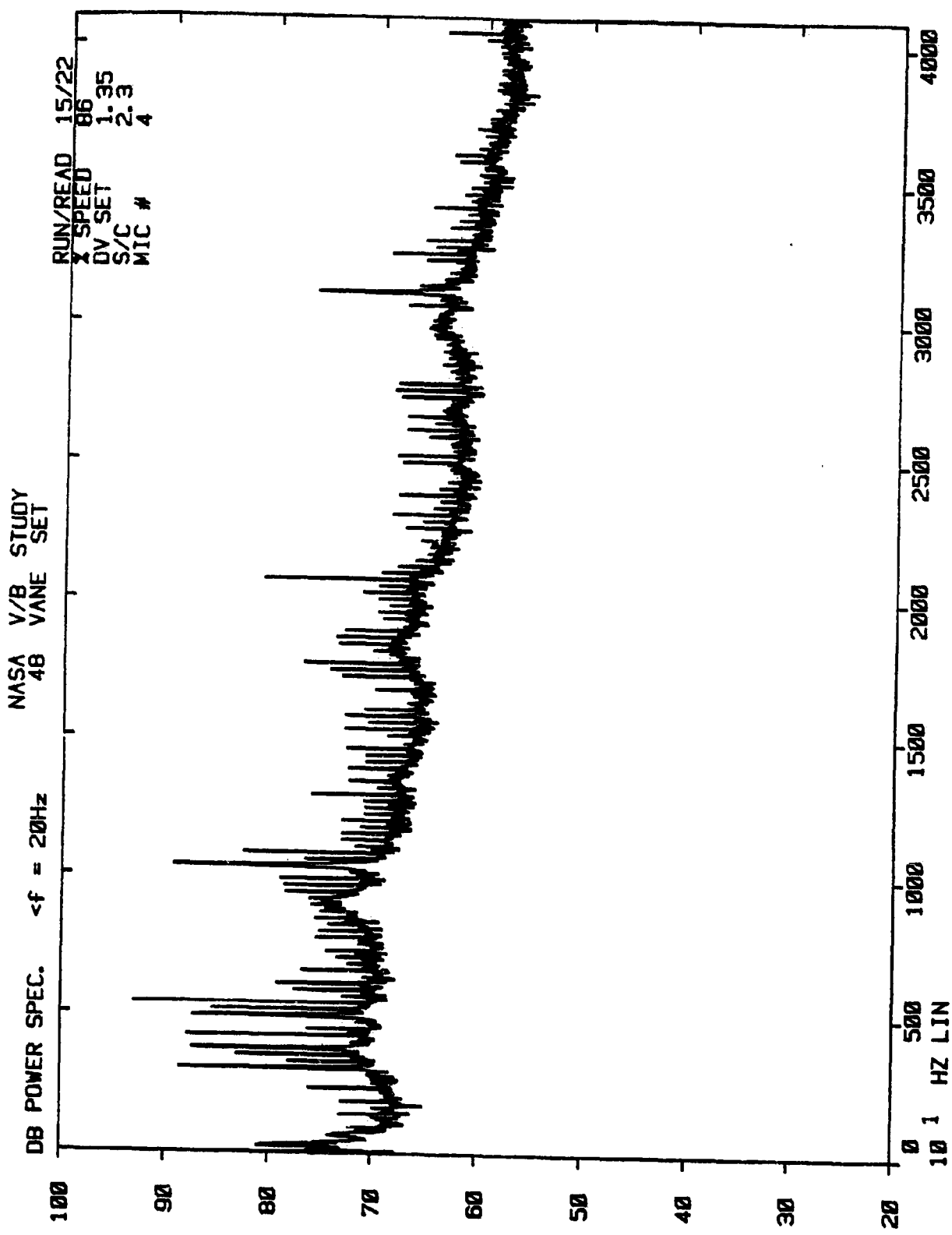


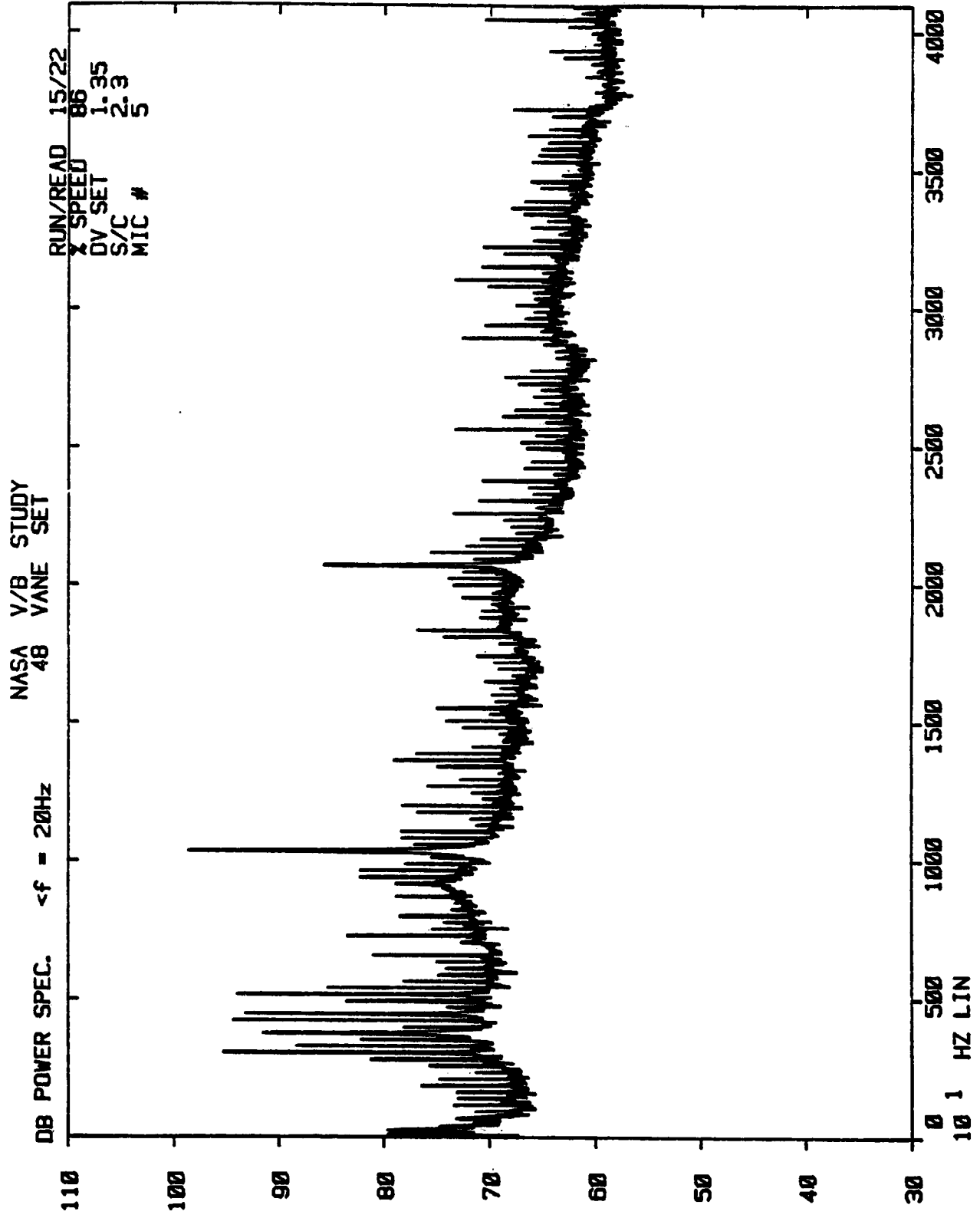


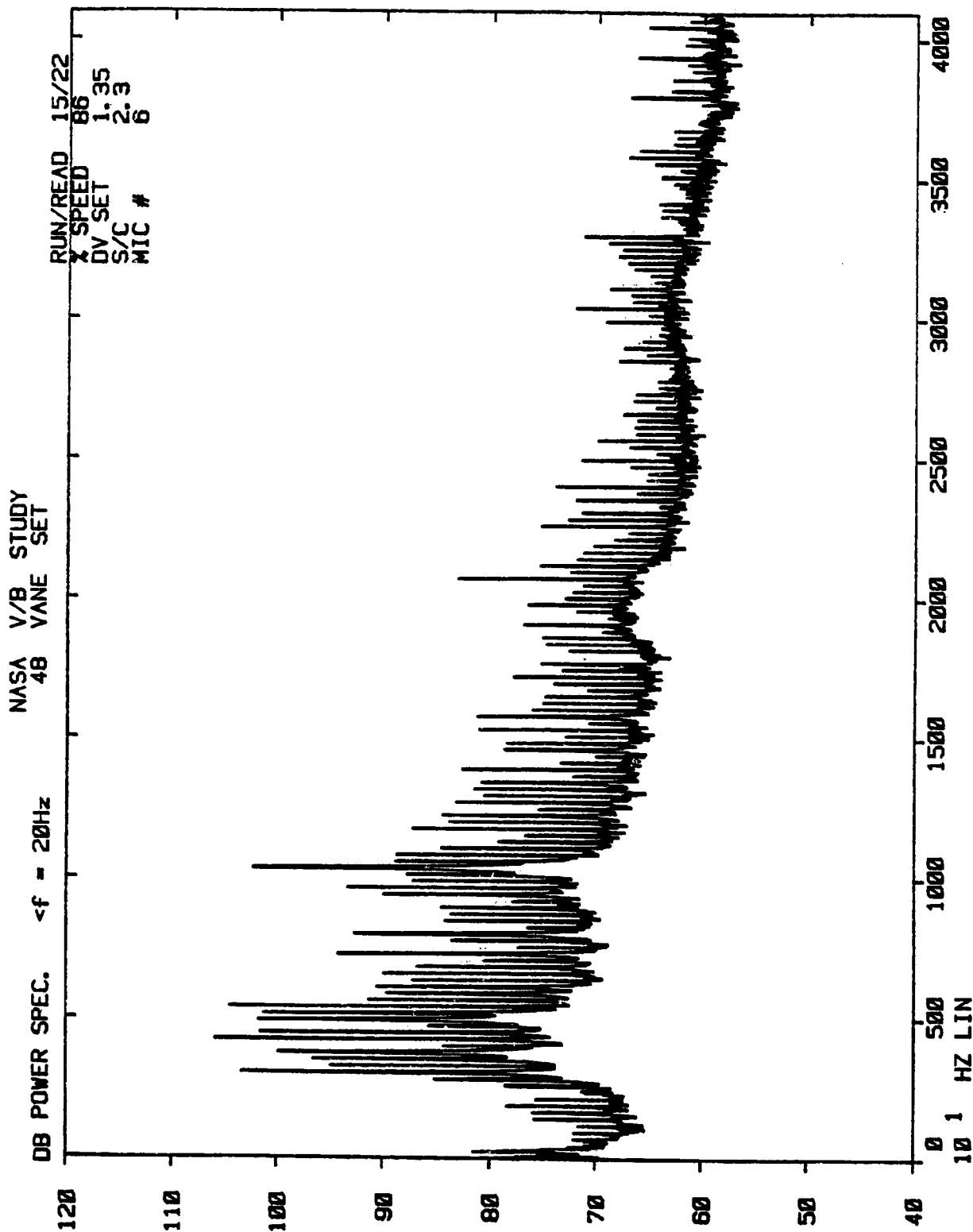


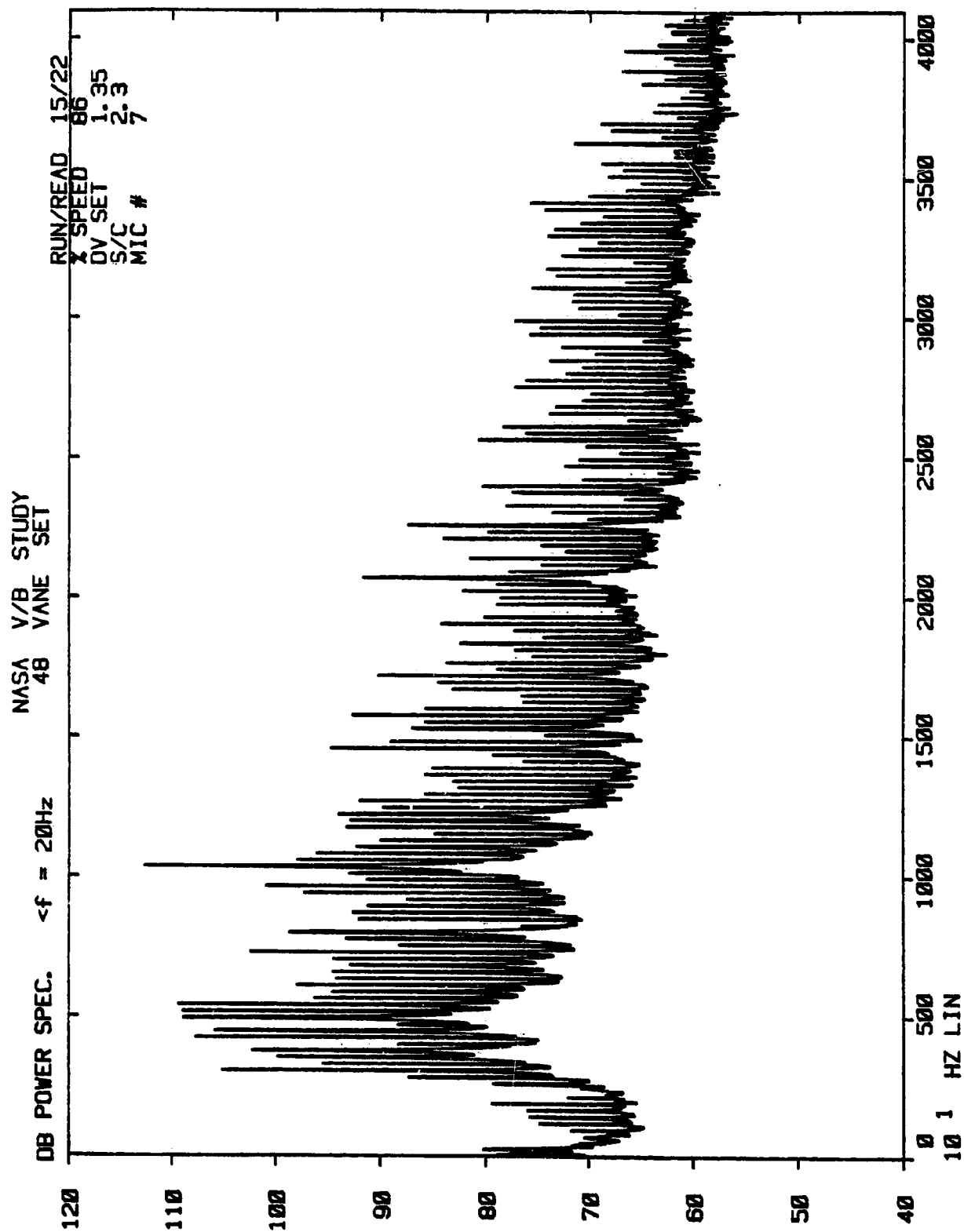


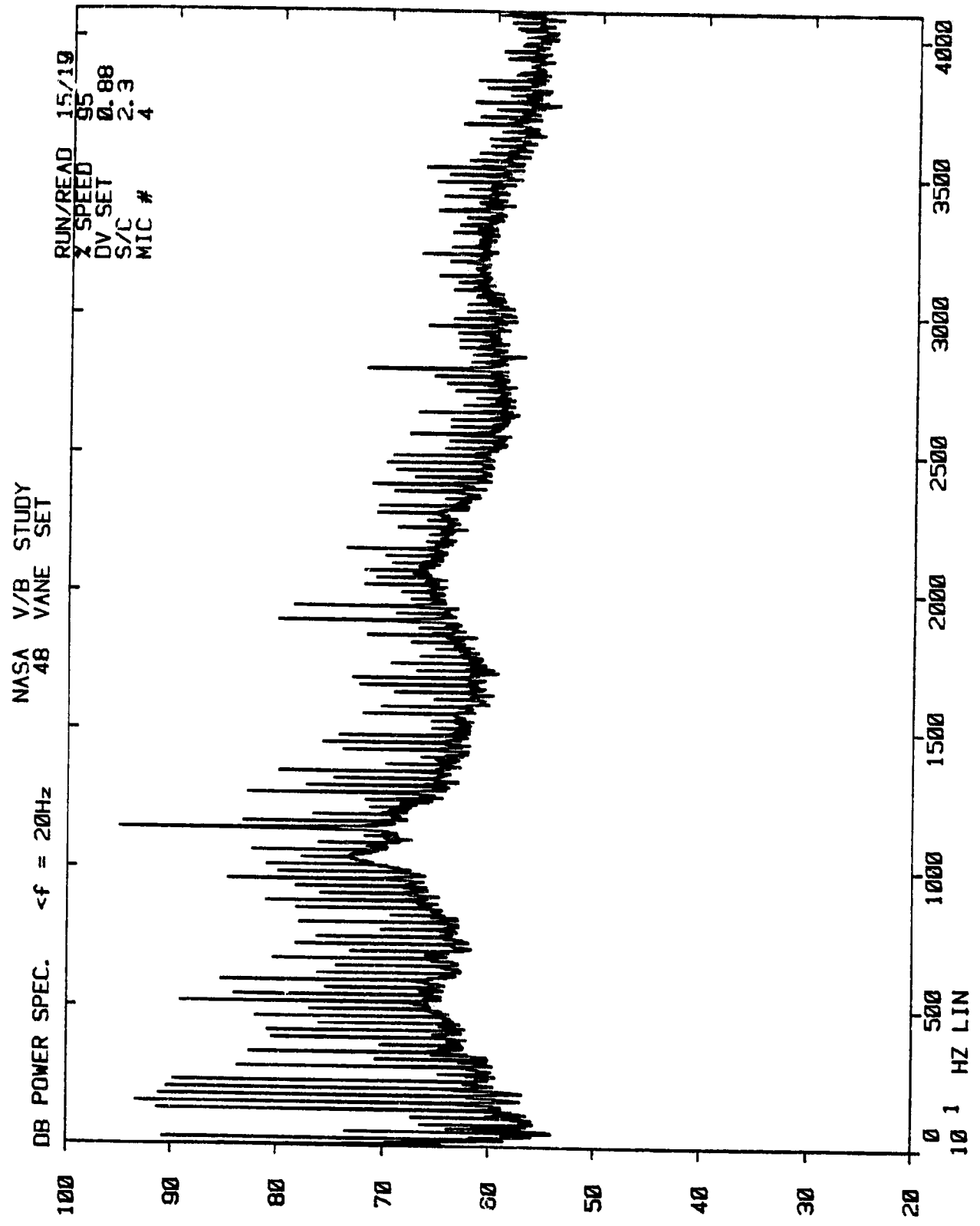


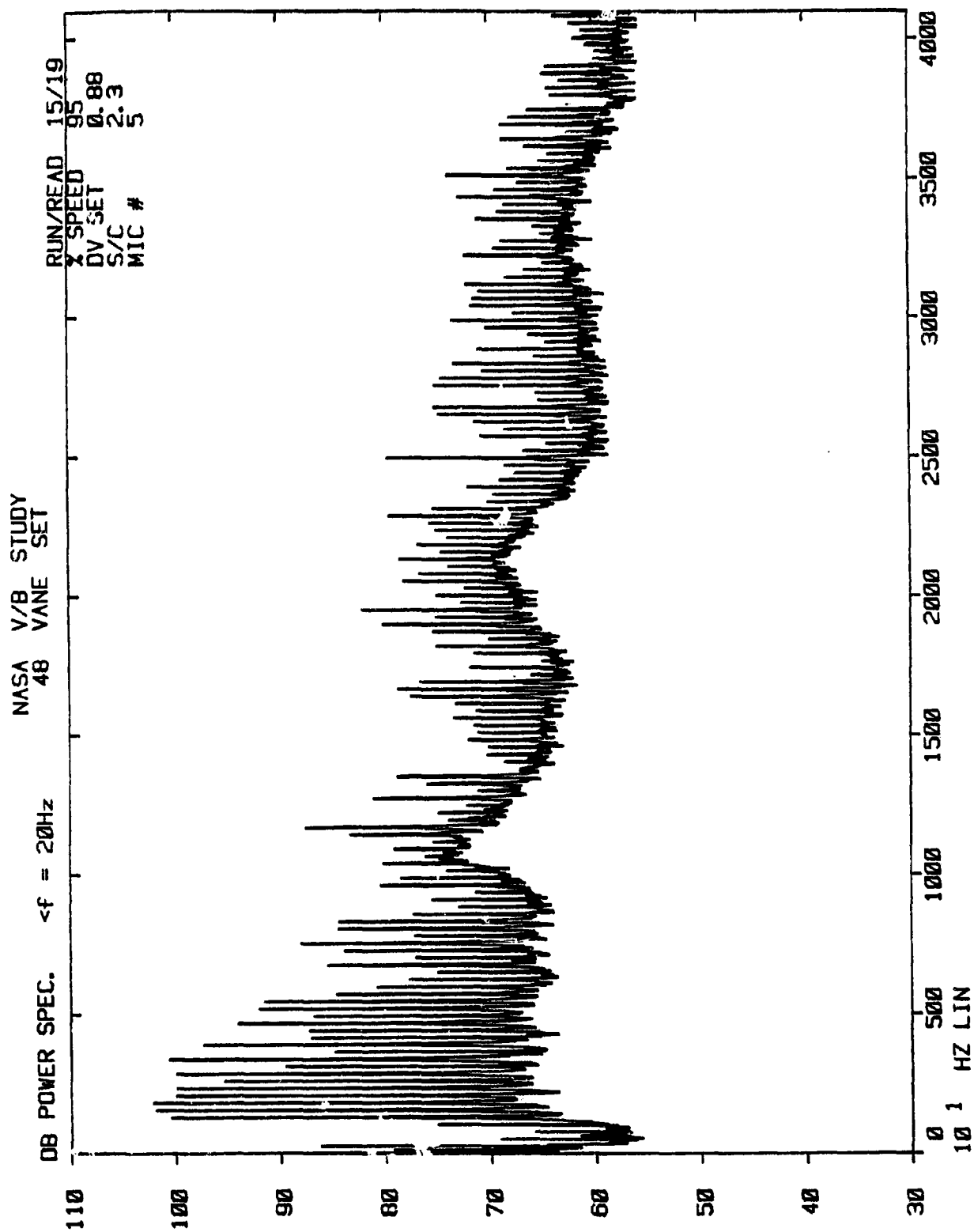


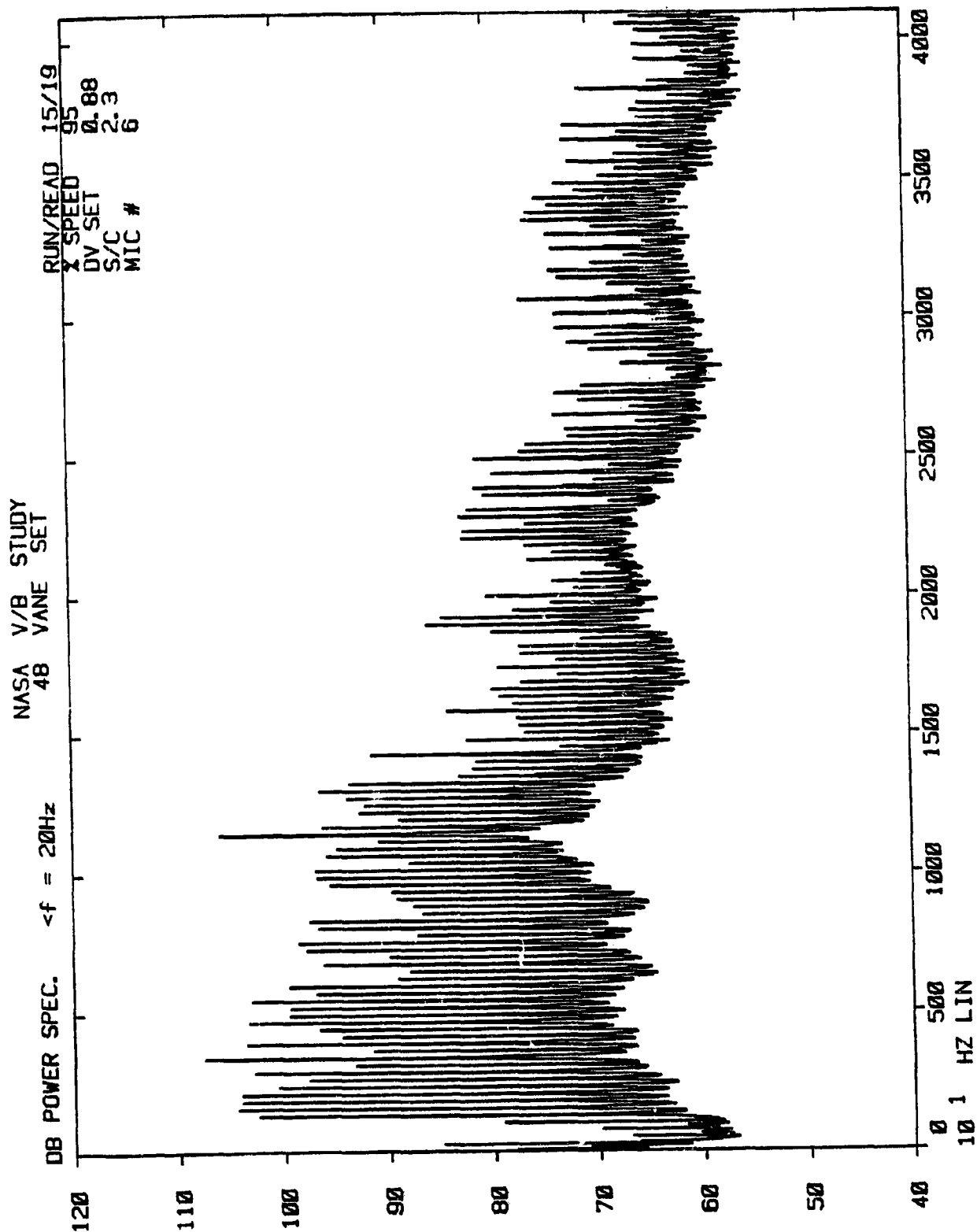


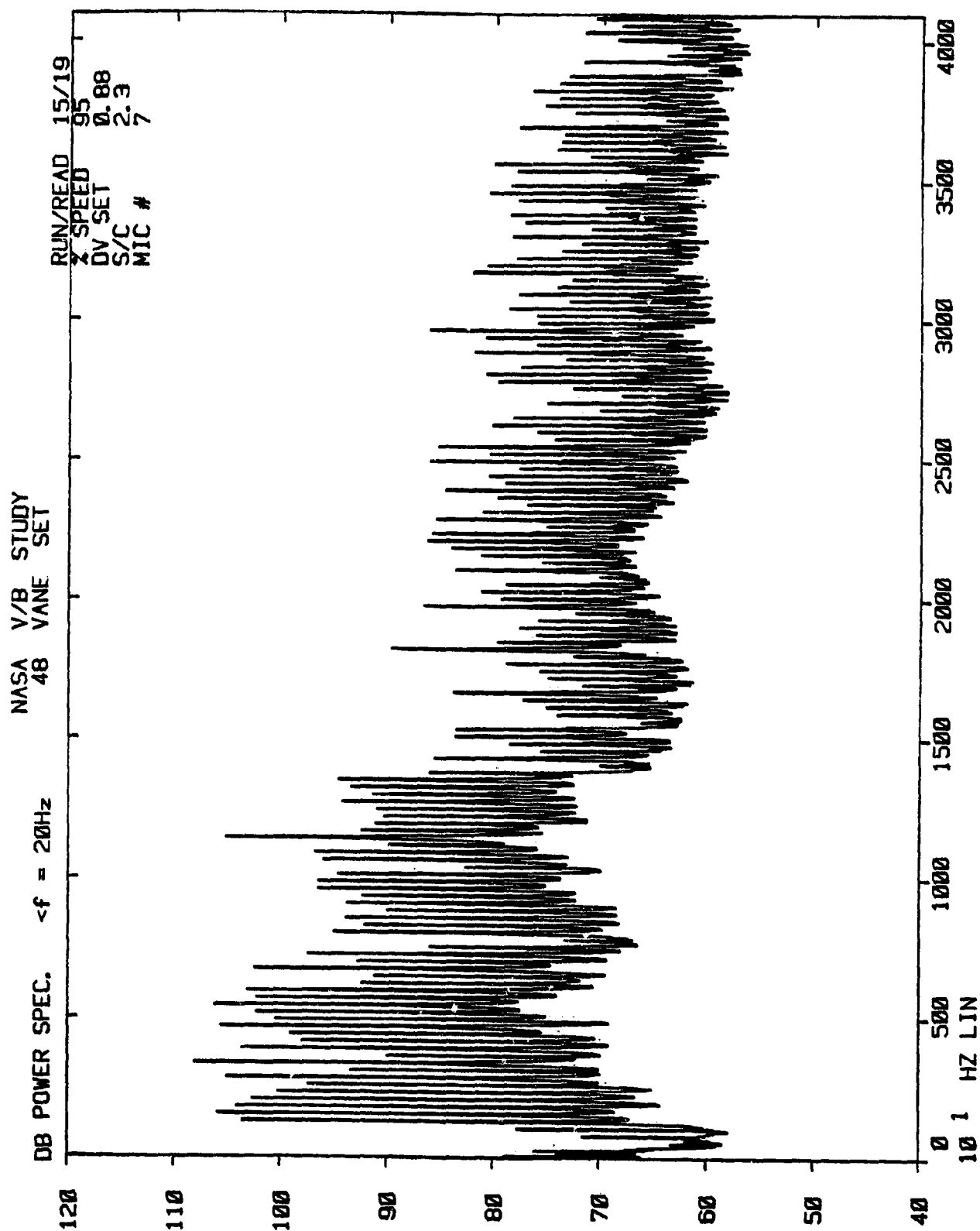


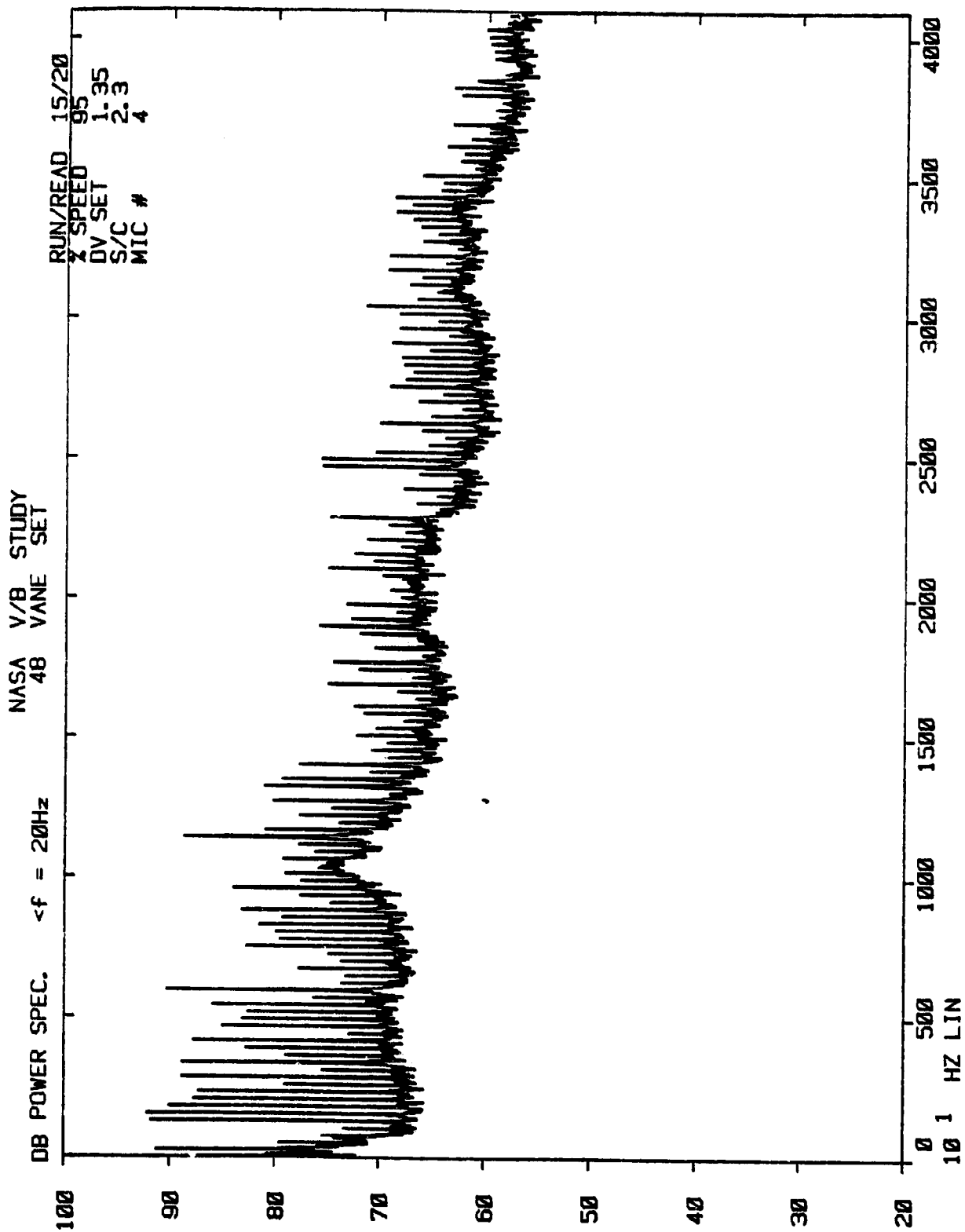












NASA V/B STUDY
48 VANE SET

<f = 20Hz

DB POWER SPEC.

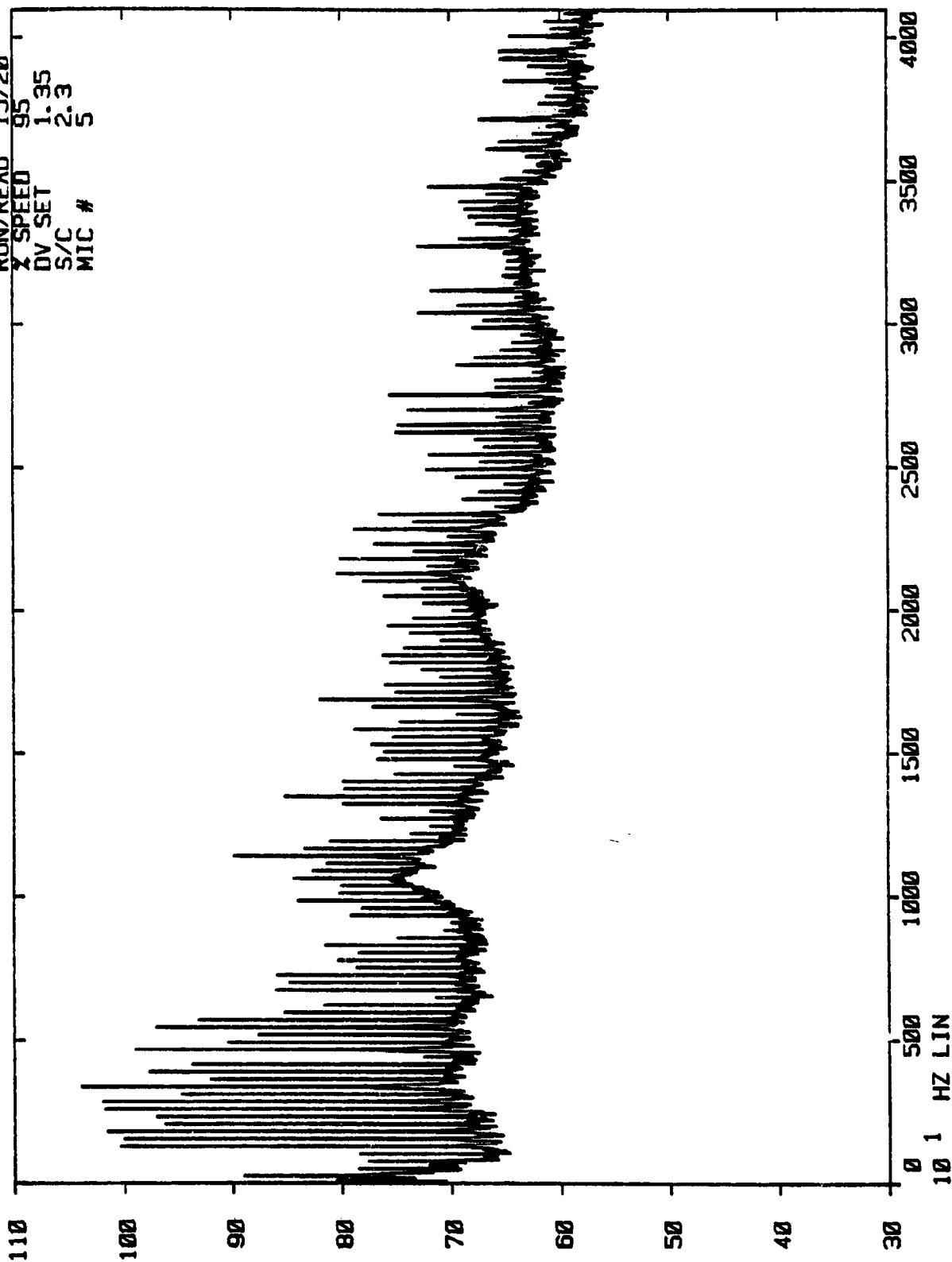
RUN/READ 15/20

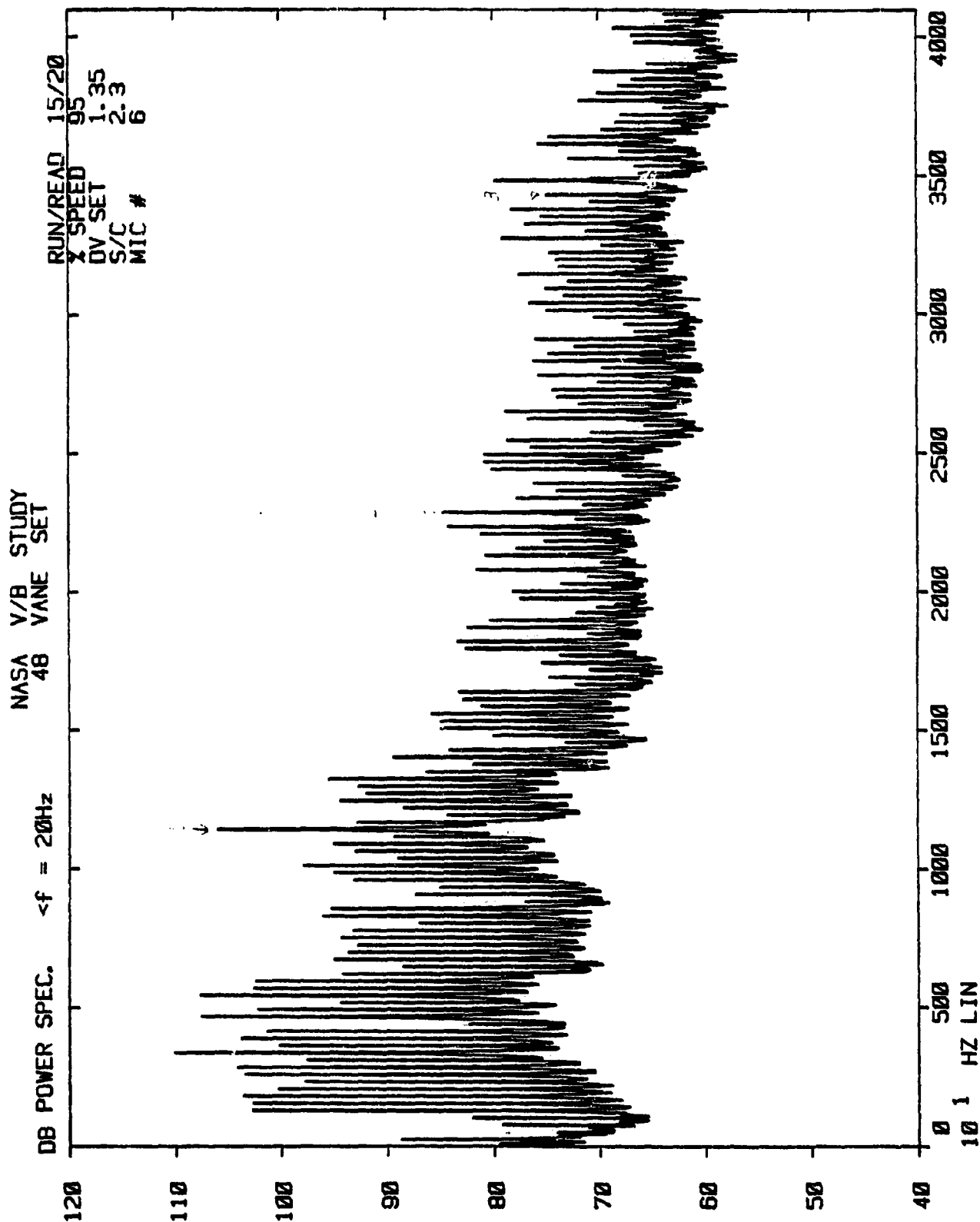
X SPEED 95

DV SET 1.35

S/C 2.3

MIC # 5

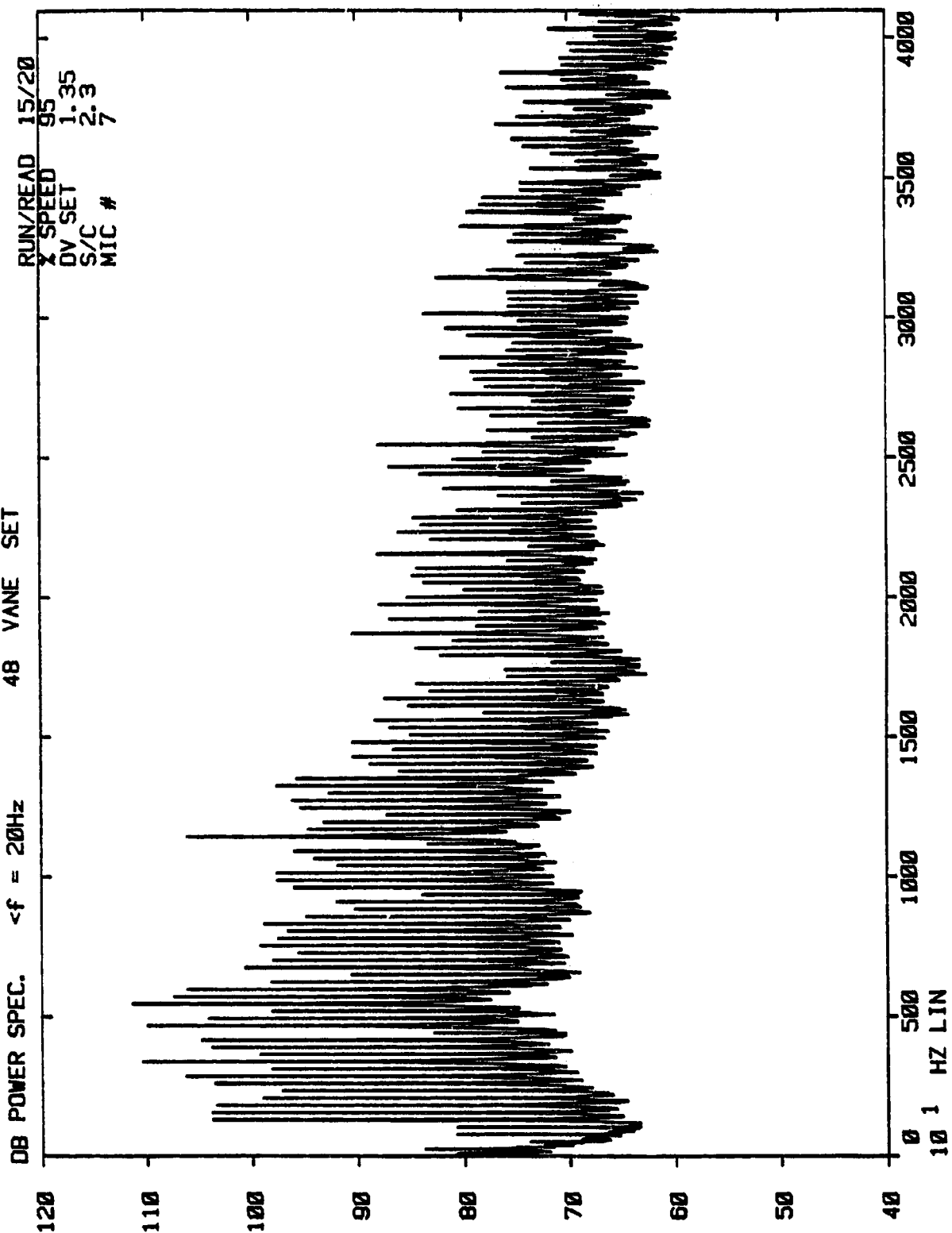


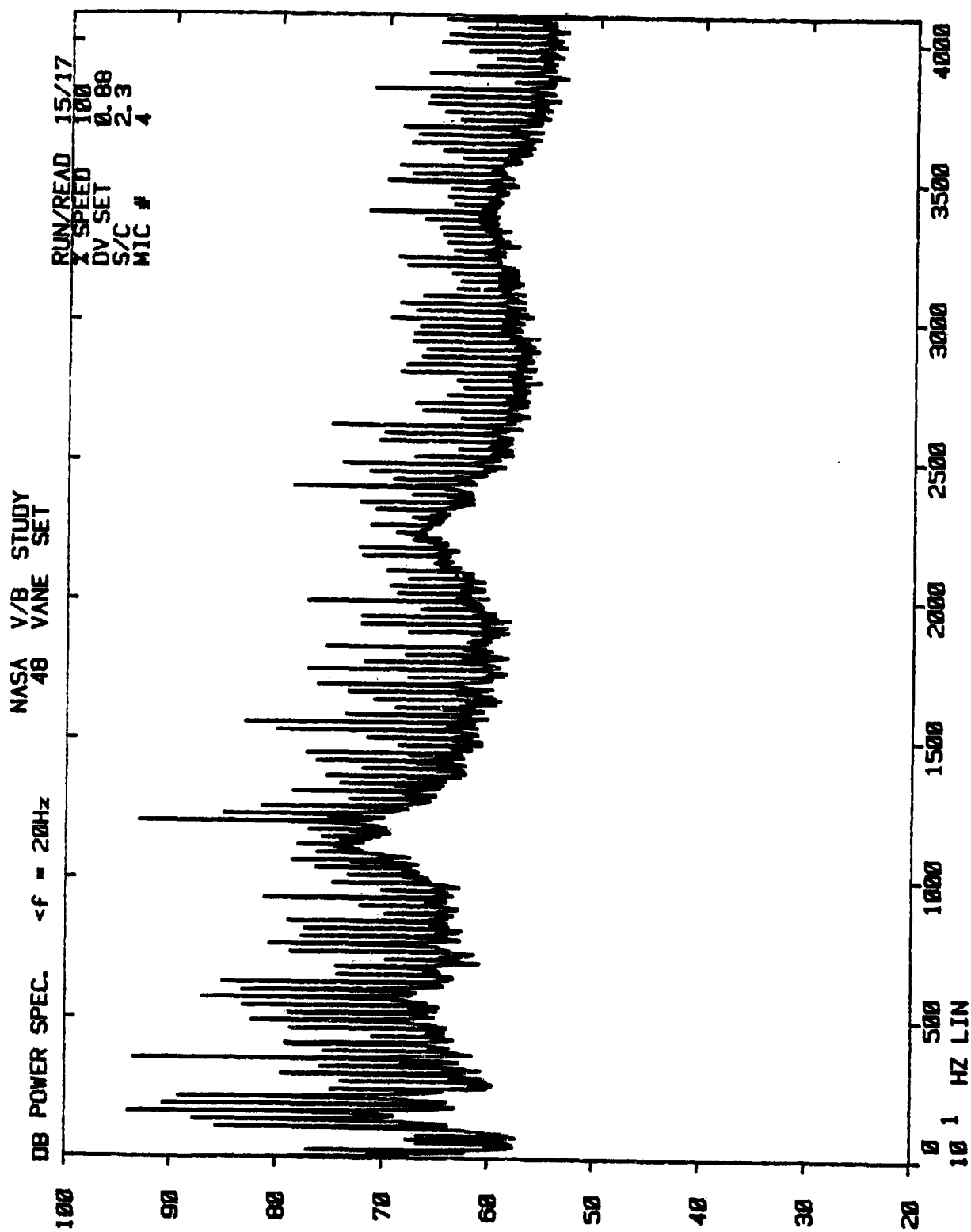


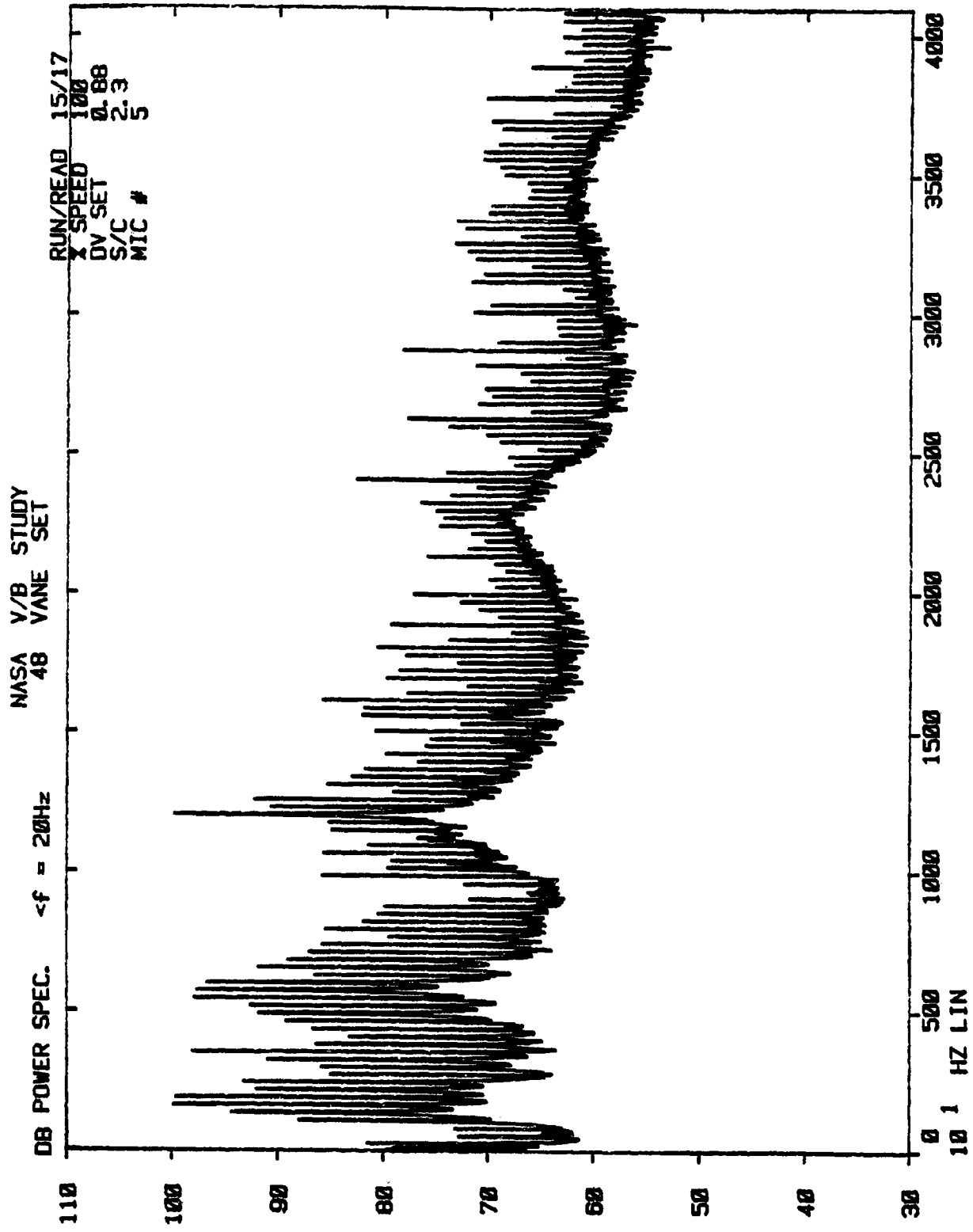
NASA V/B STUDY
48 VANE SET

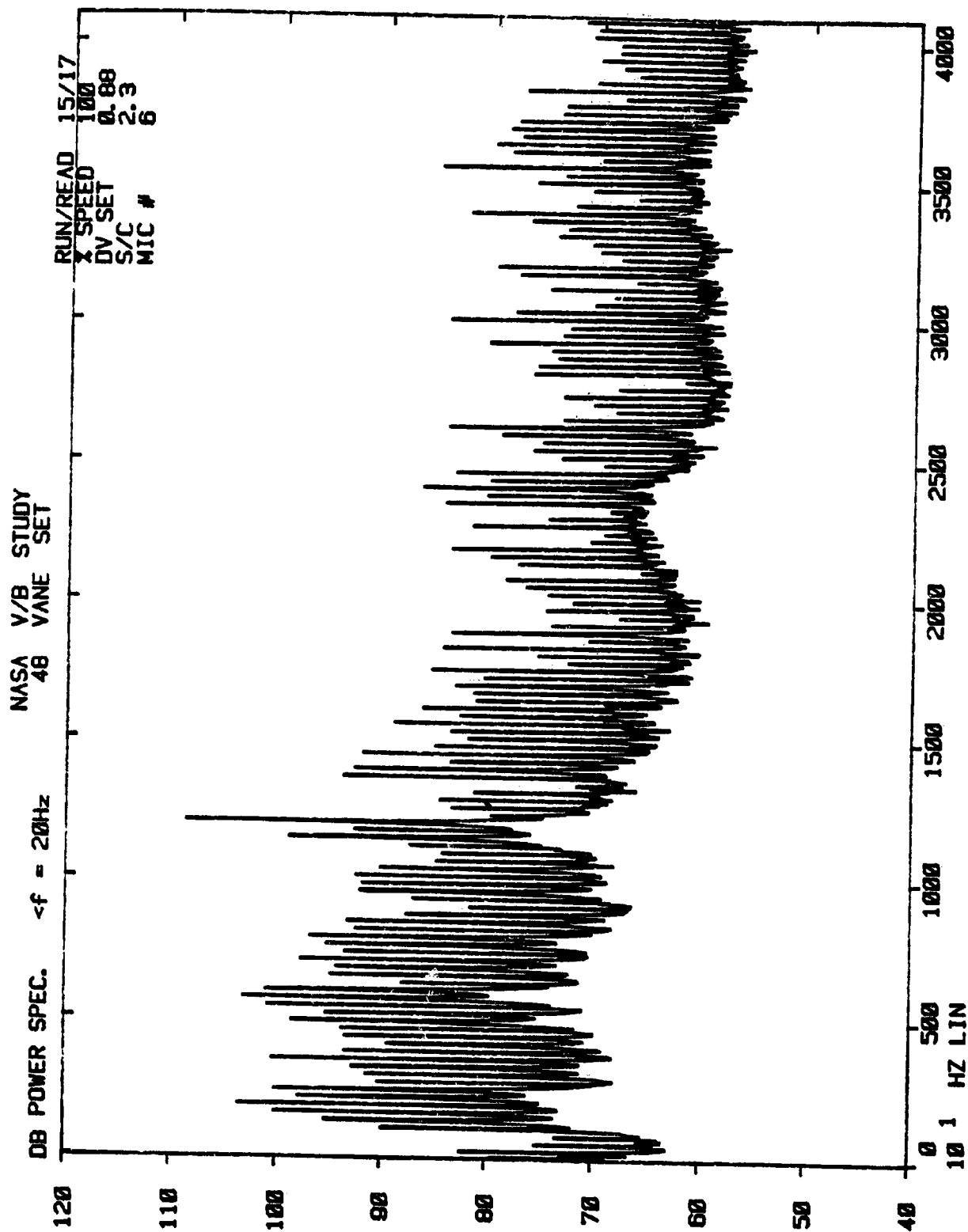
<f = 20Hz

DB POWER SPEC.







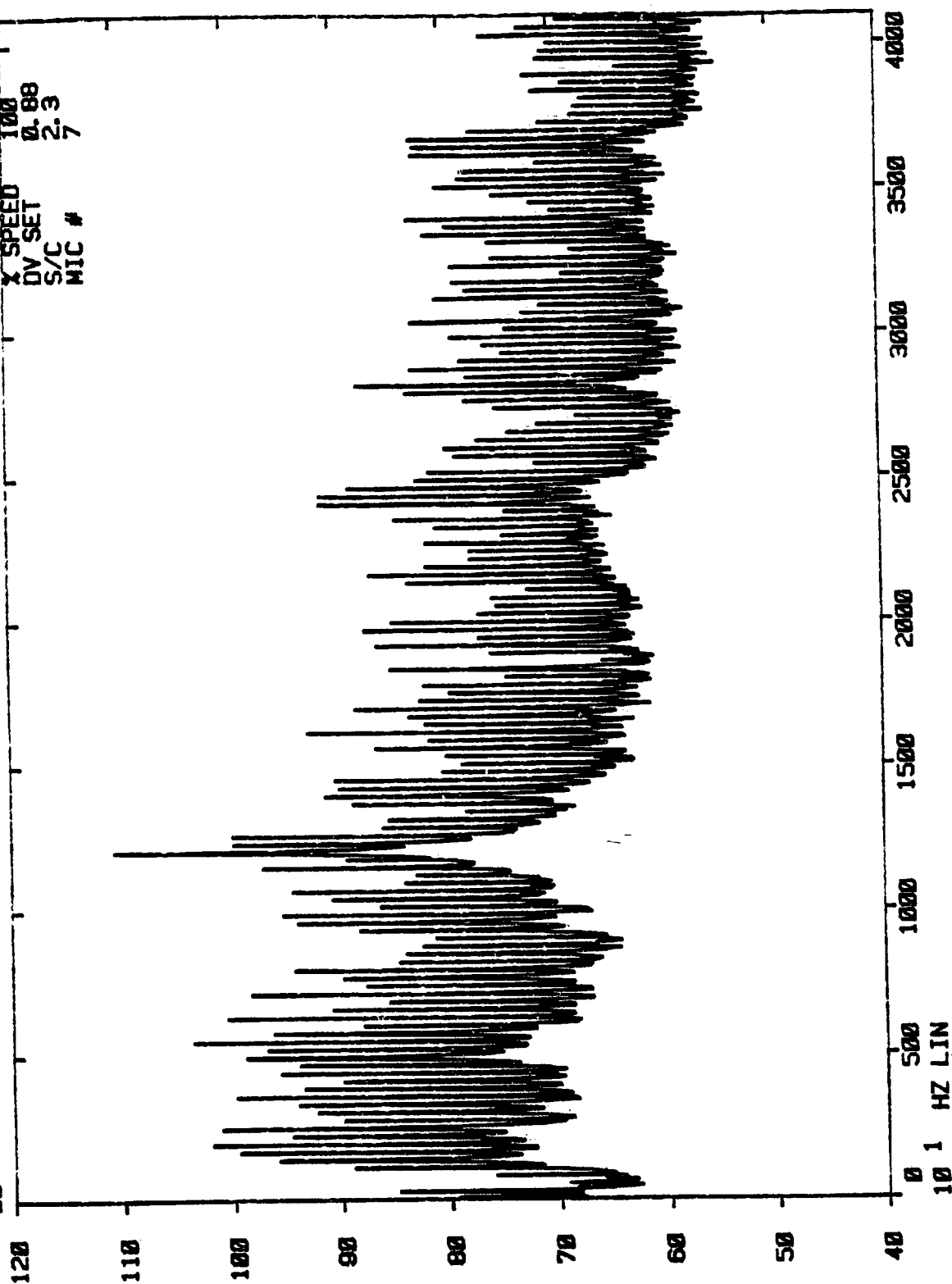


NASA V/B STUDY
48 VANE SET

<f = 20Hz

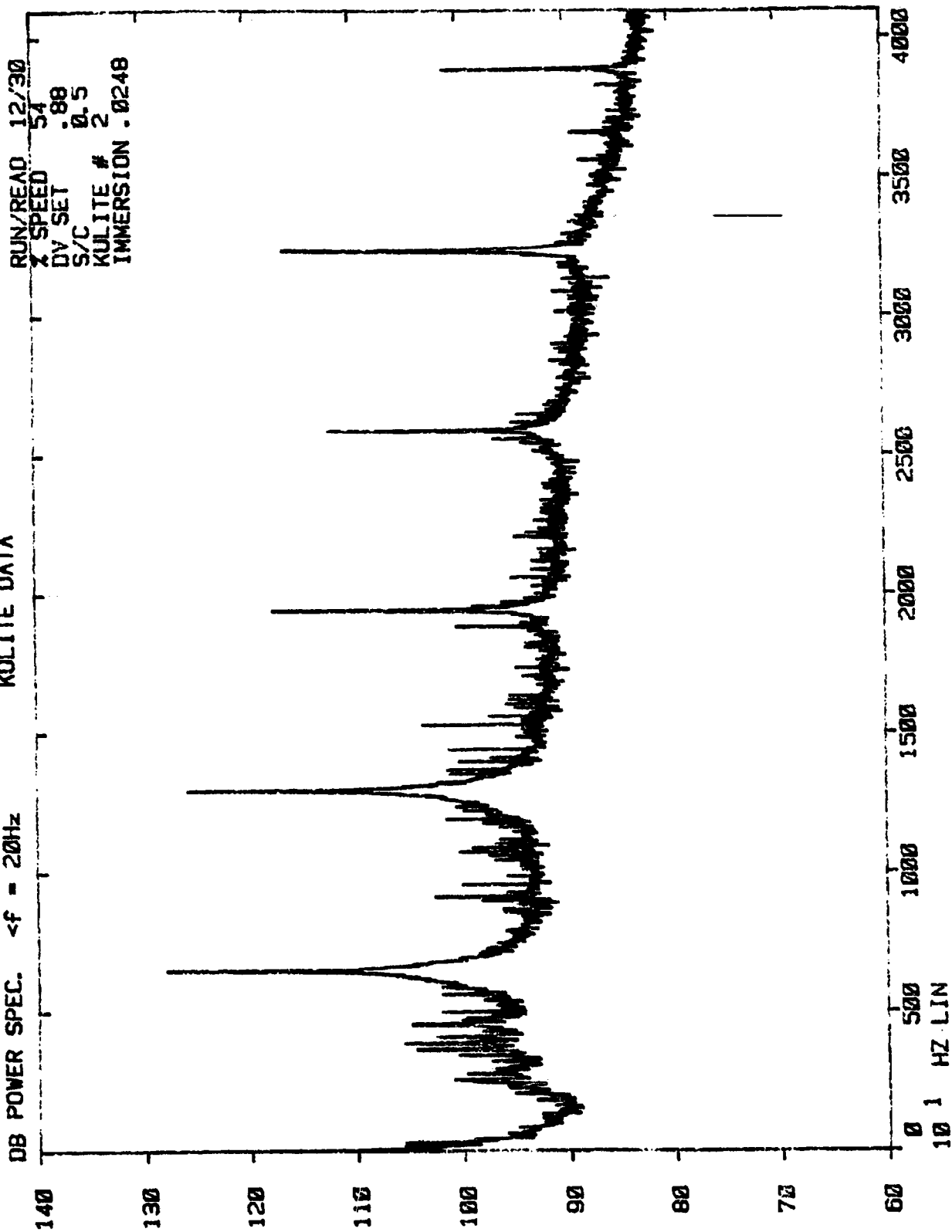
DB POWER SPEC.

RUN/READ 15/17
X SPEED 100
DV SET 0.88
S/C 2.3
MIC # 7



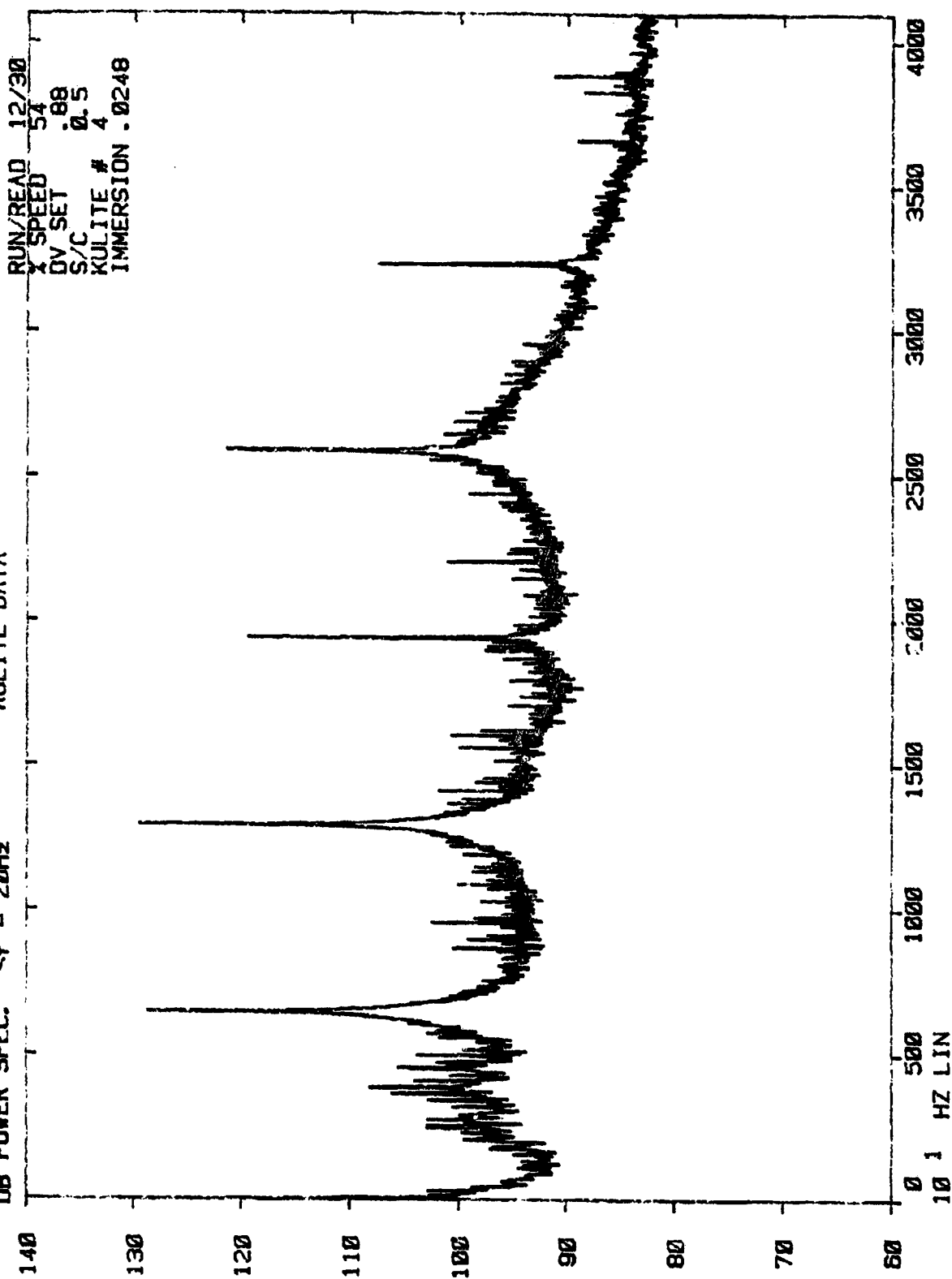
NASA V/B STUDY
KULITE DATA

DB POWER SPEC. $< f = 20\text{Hz}$



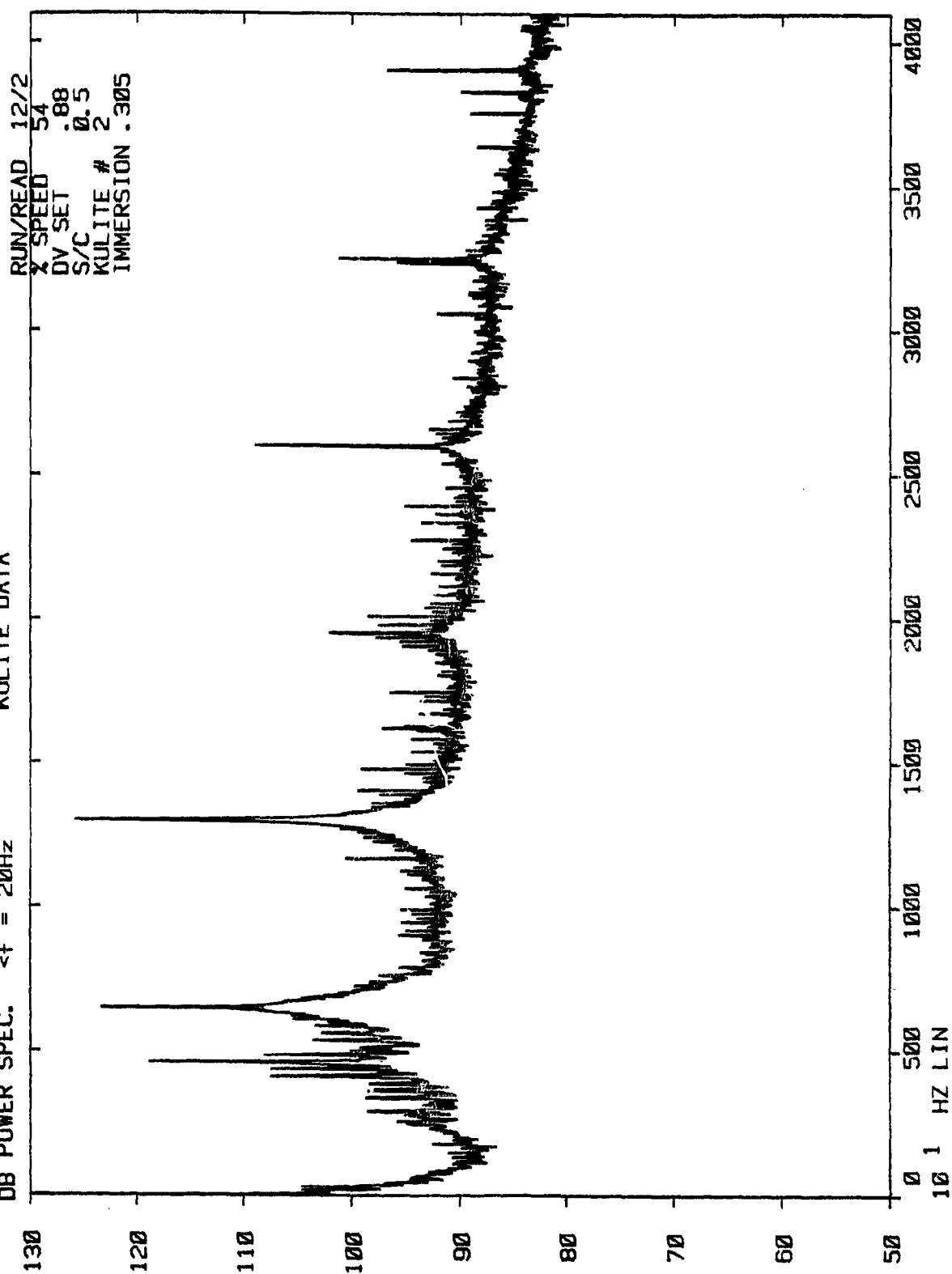
NASA V/B STUDY
KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$



NASA V/B STUDY KULITE DATA

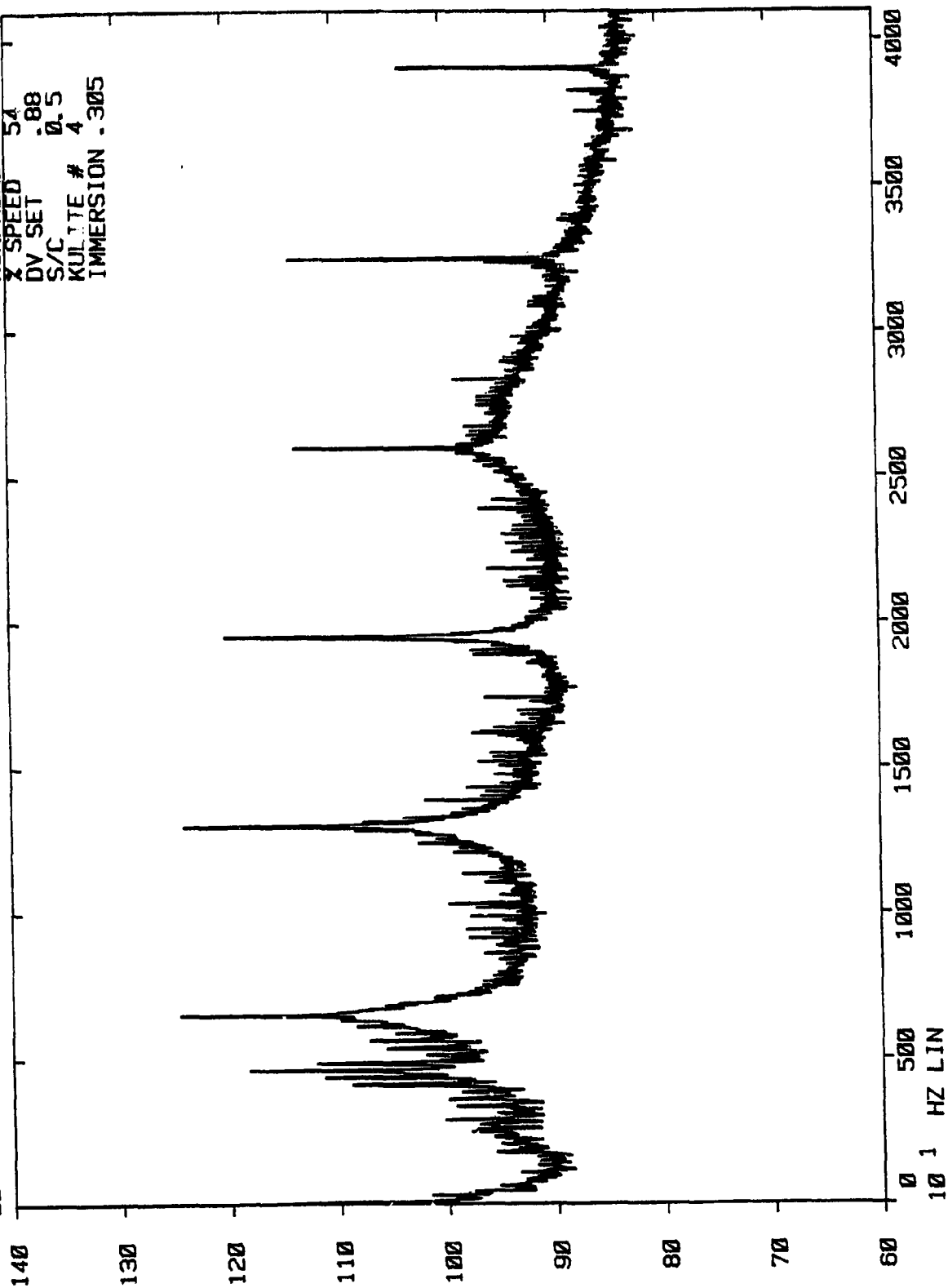
DB POWER SPEC. $\Delta f = 20\text{Hz}$



NASA V/B STUDY KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$

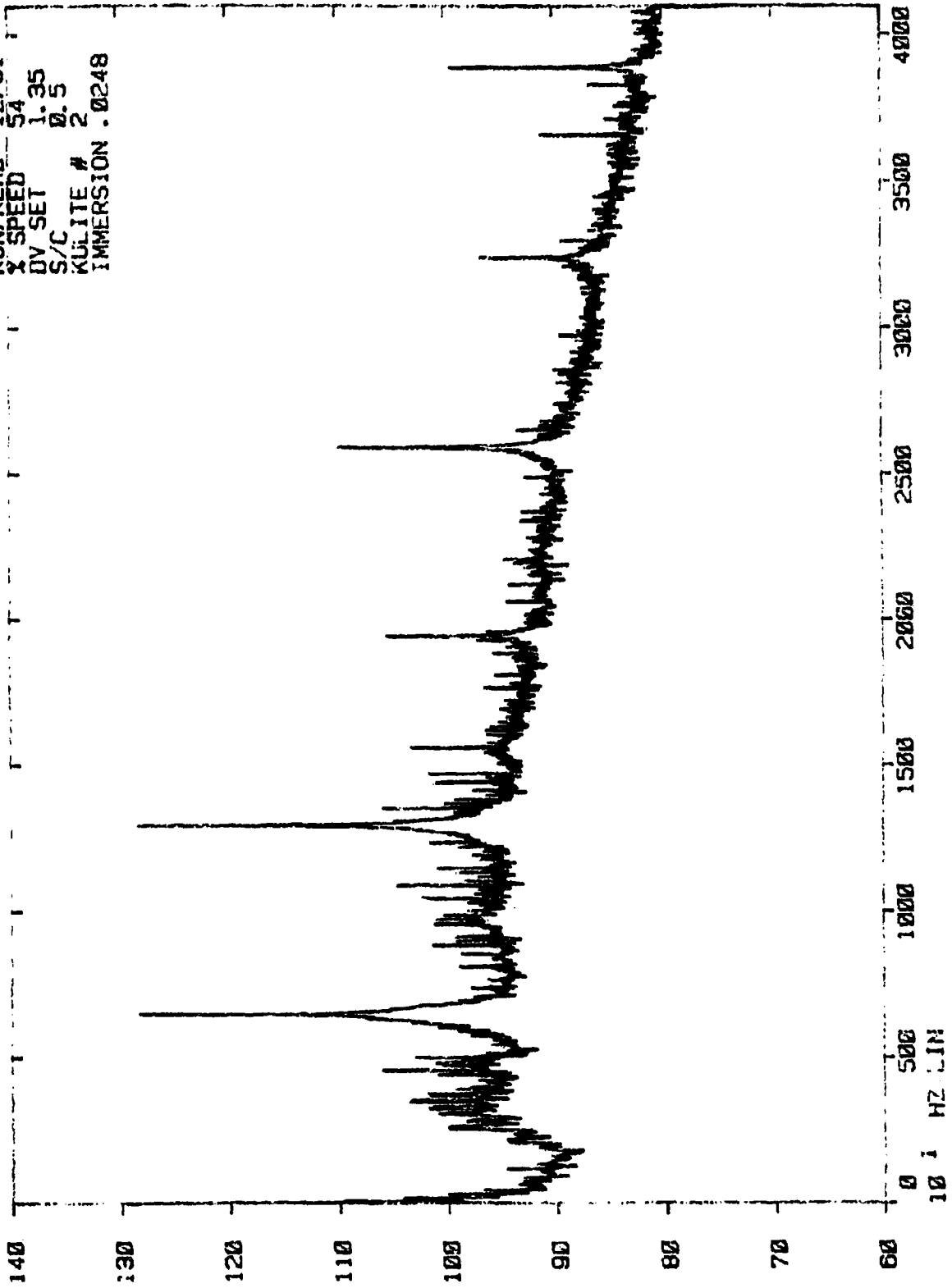
RUN/READ 12/2
X SPEED 54
DV SET .88
S/C 0.5
KULITE # 4
IMMERSION .305



NASA V/B STUDY KULITE DATA

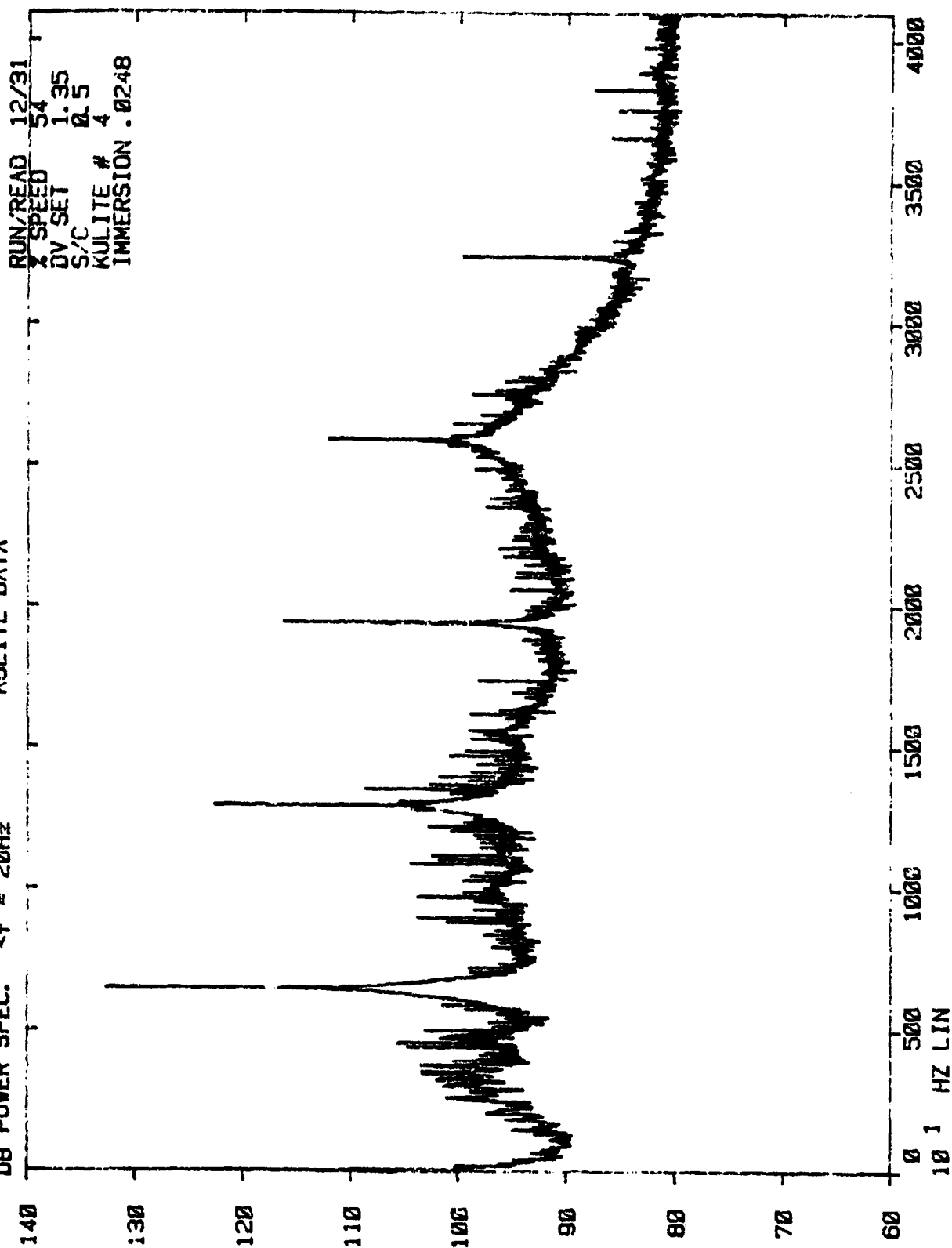
DB POWER SPEC. $\Delta f = 20\text{Hz}$

RUN/READ 12/31
X SPEED 54
DV SET 1.35
S/C 0.5
KULITE # 2
IMMERSION .0248



NASA V/B STUDY
KULITE DATA

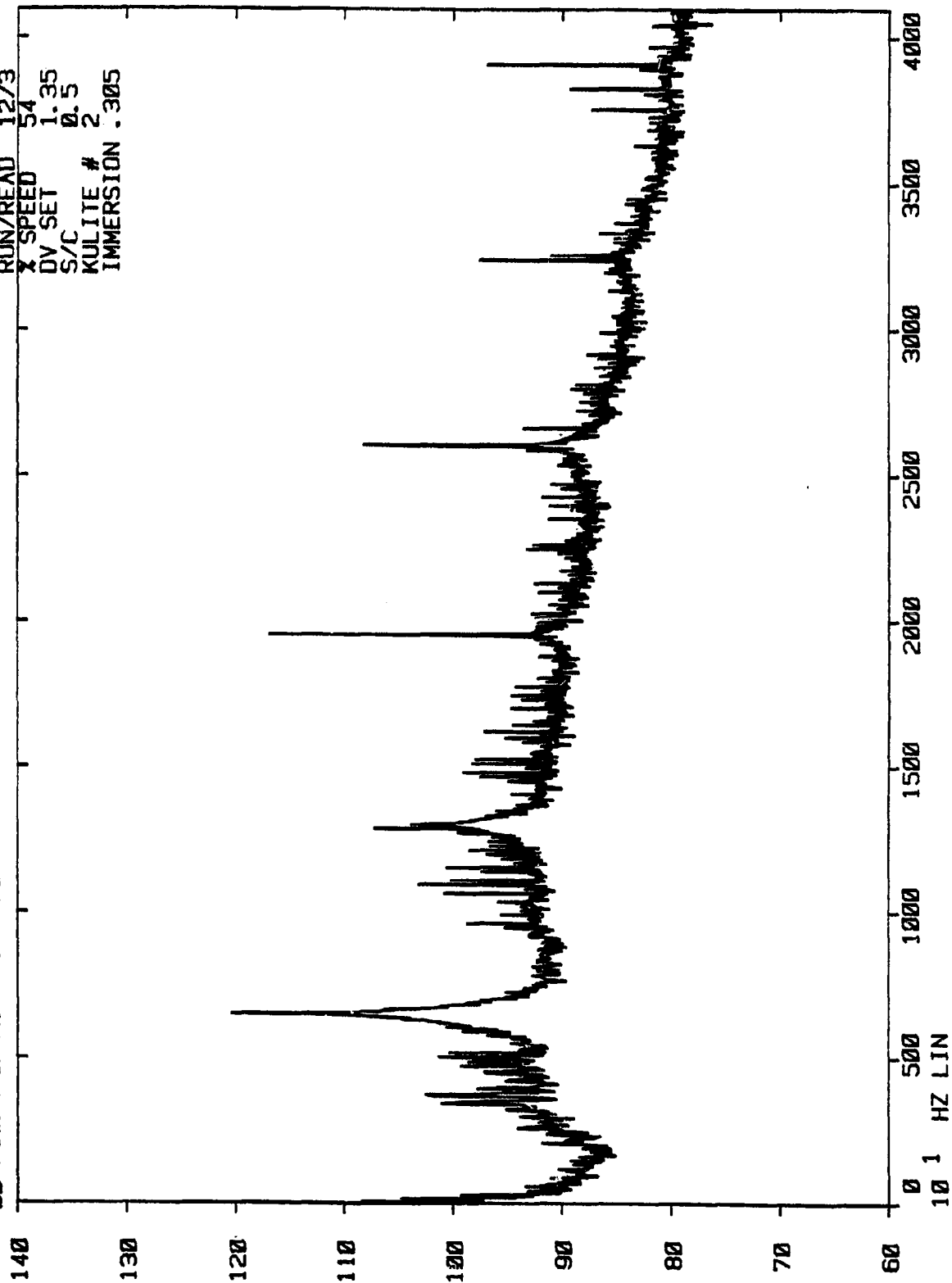
DB POWER SPEC. $<f = 20\text{Hz}$



NASA V/B STUDY KULITE DATA

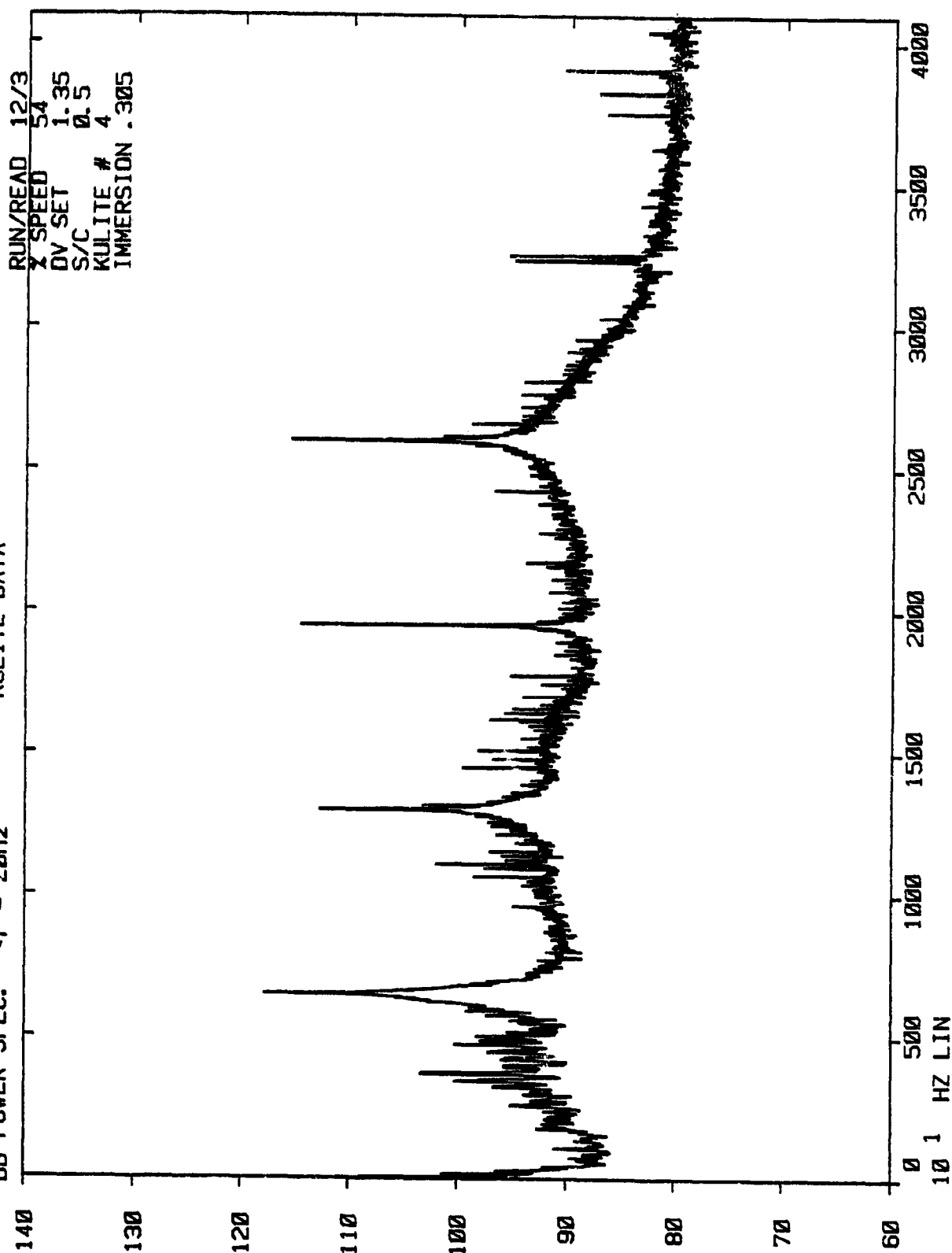
DB POWER SPEC. $<f = 20\text{Hz}$

RUN/READ 12/3
X SPEED 54
DV SET 1.35
S/C 0.5
KULITE # 2
IMMERSION .305



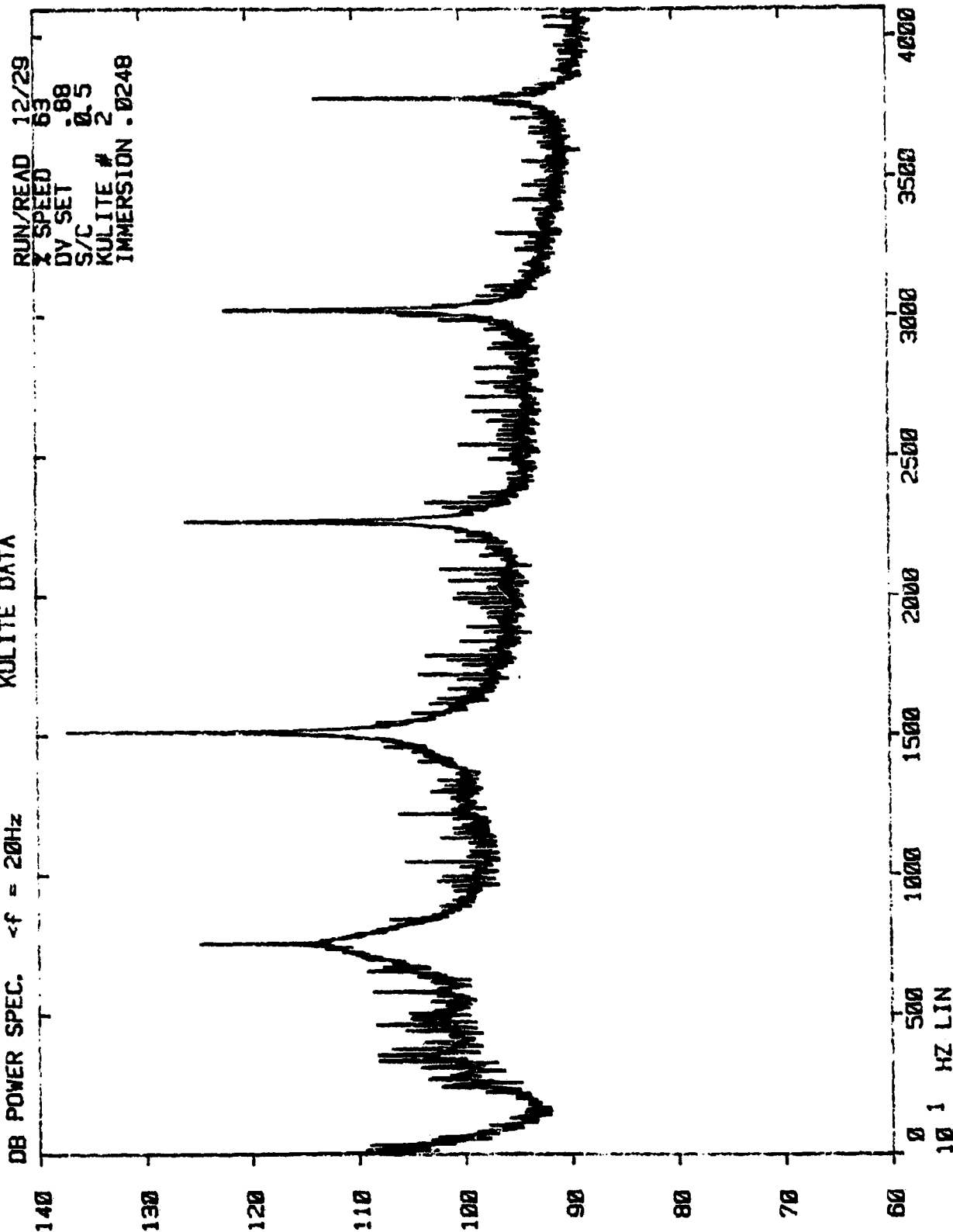
NASA V/B STUDY KULITE DATA

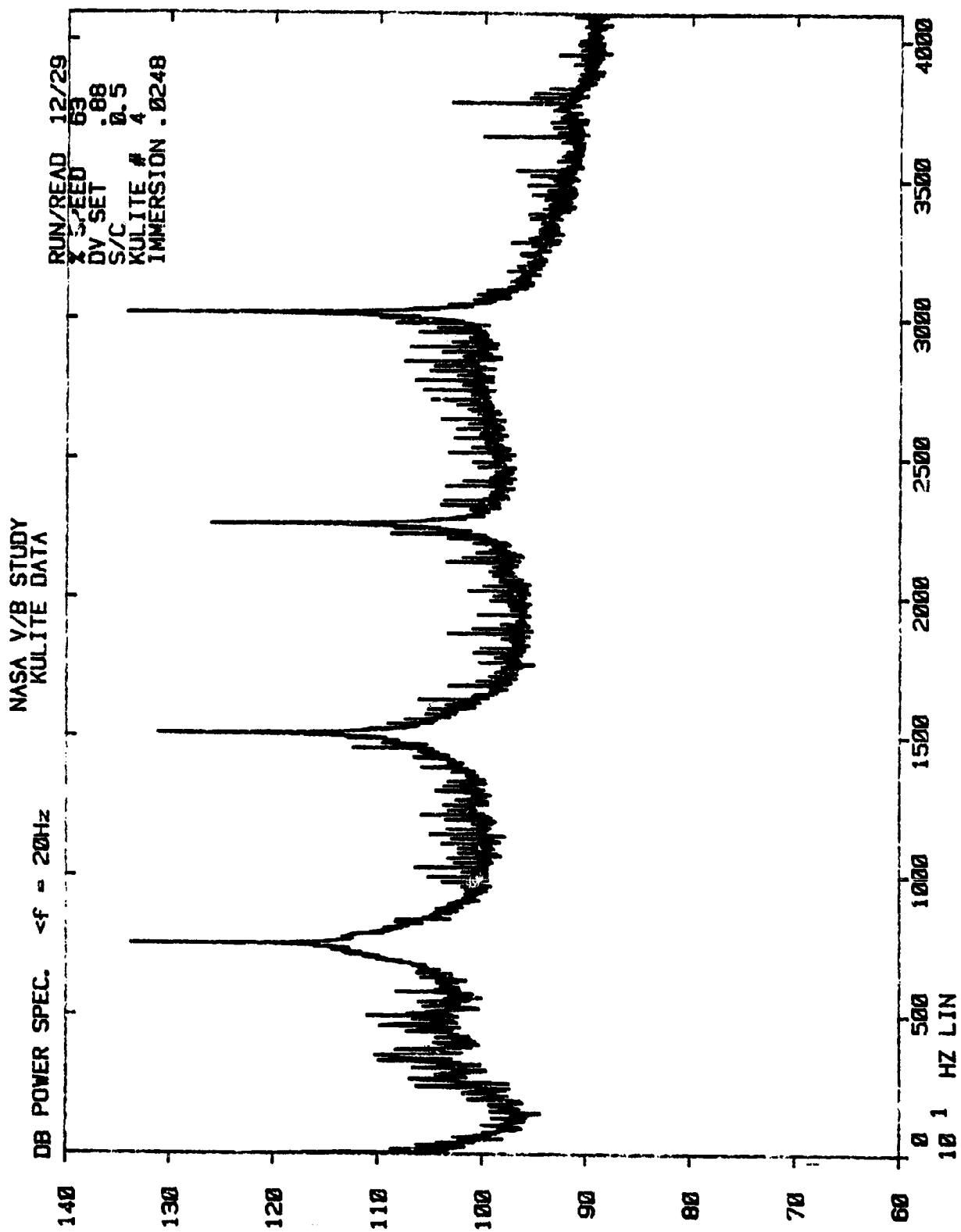
DB POWER SPEC. $\Delta f = 20\text{Hz}$



NASA Y/B STUDY
KULITE DATA

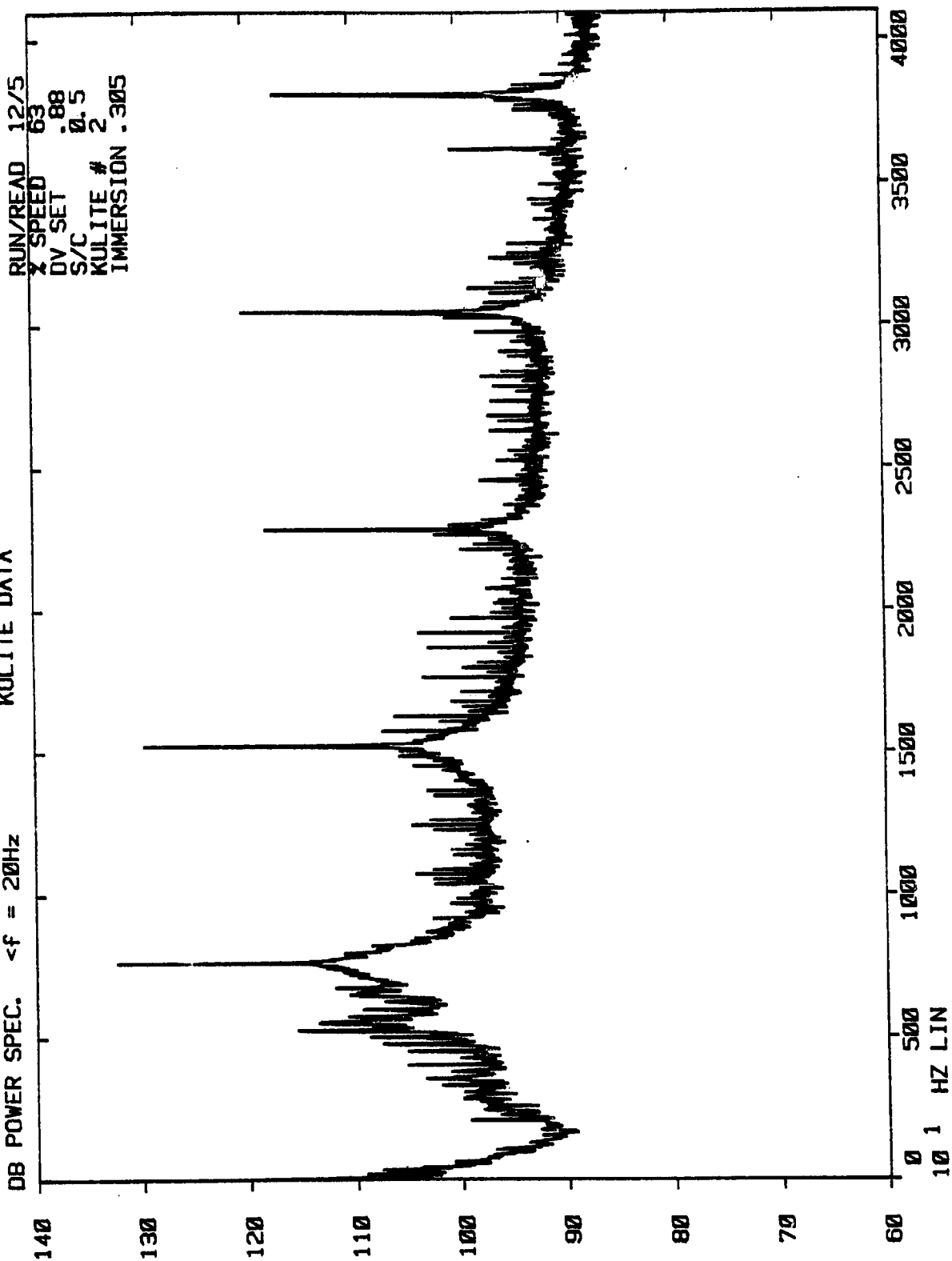
DB POWER SPEC. $\Delta f = 20\text{Hz}$





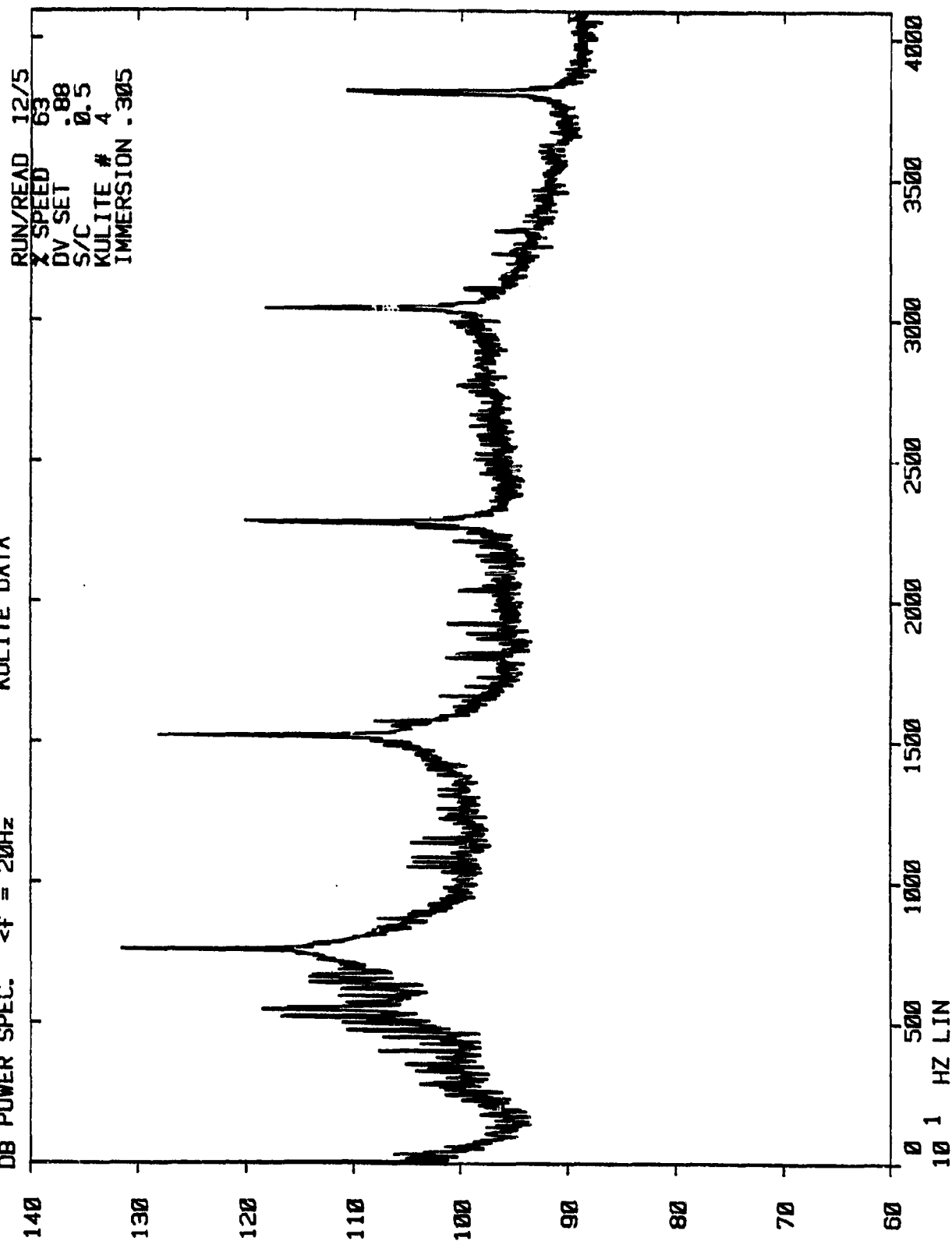
NASA V/B STUDY KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$

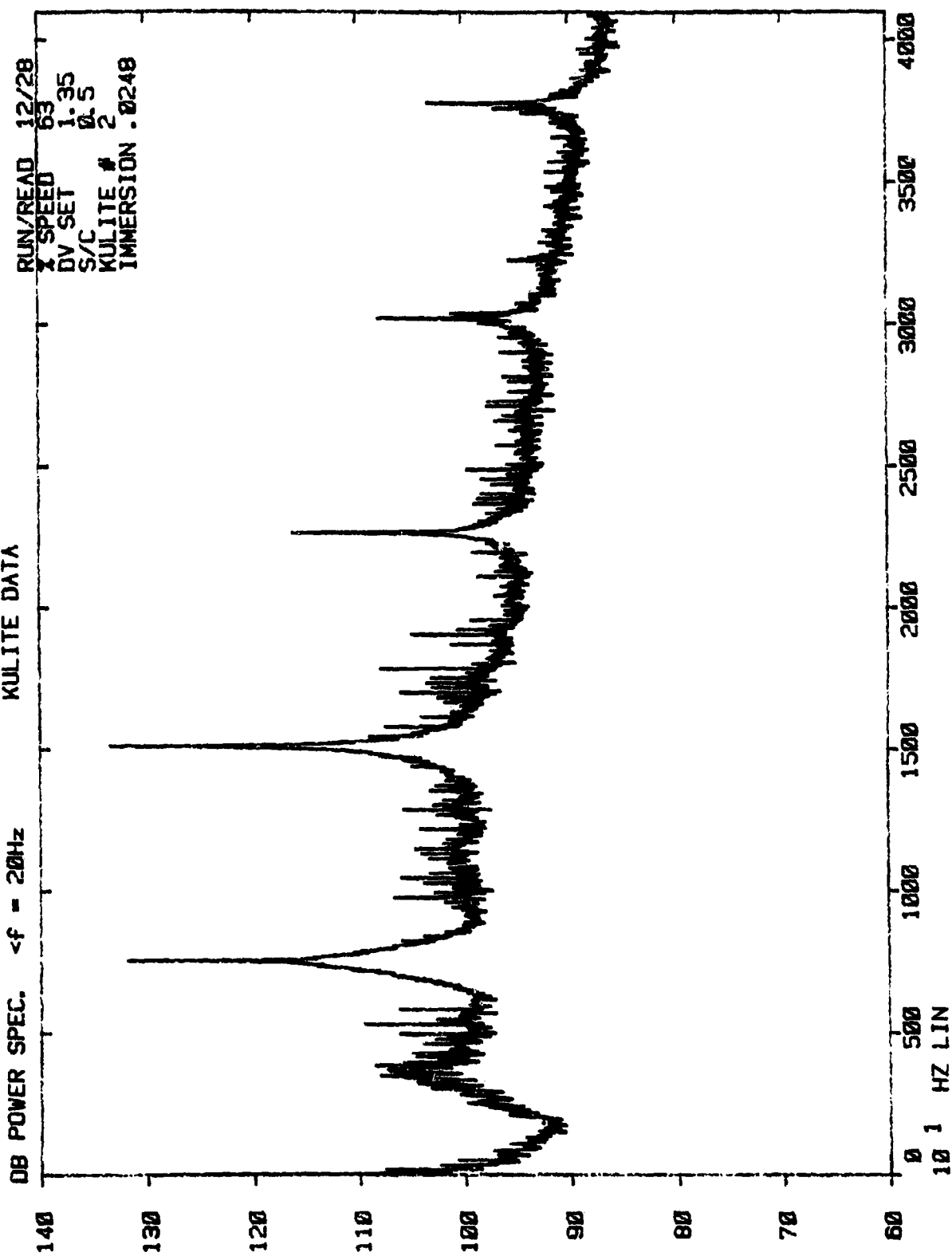


NASA V/B STUDY KULITE DATA

DB POWER SPEC. $\langle f = 20\text{Hz}$



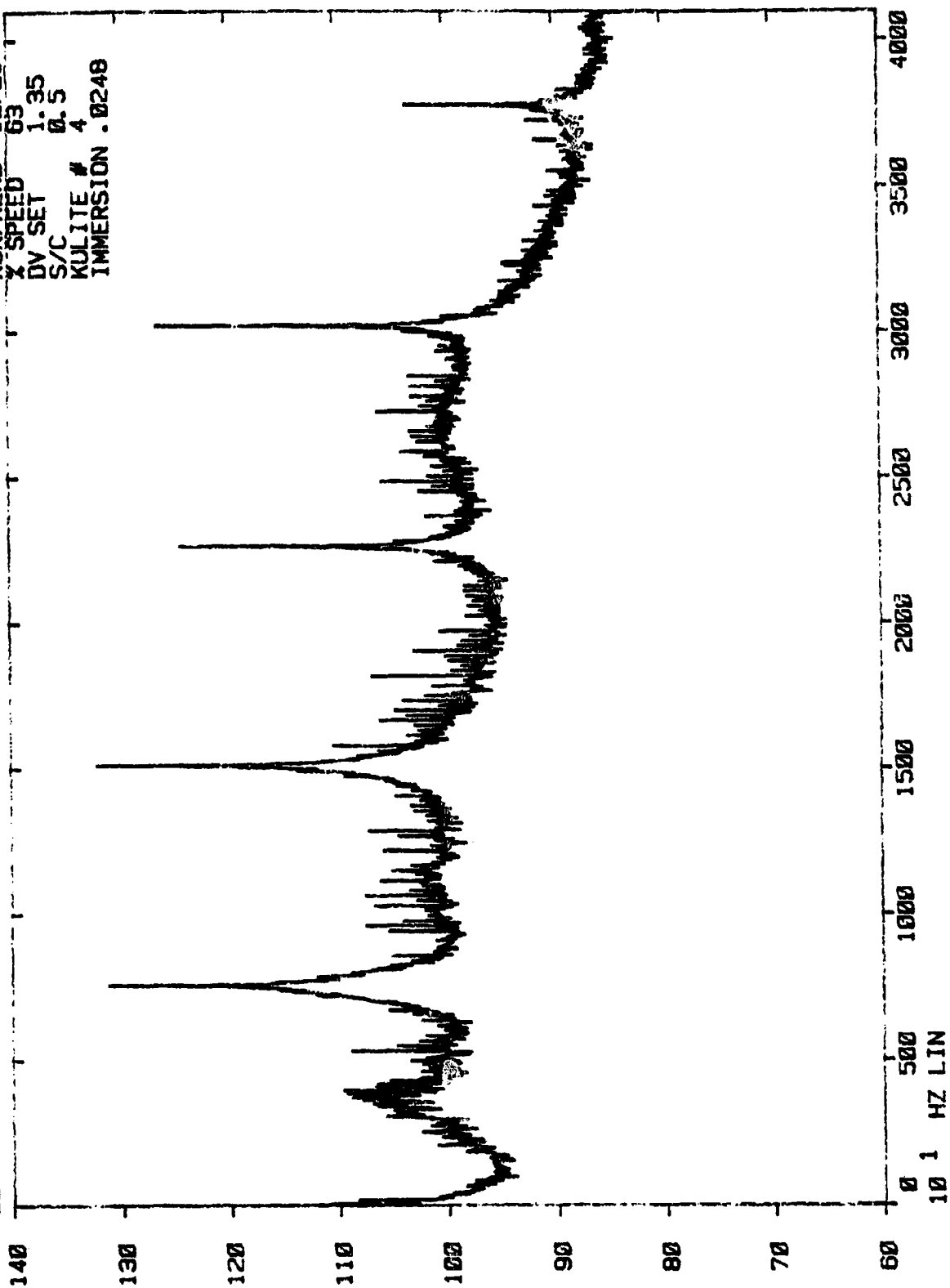
NASA V/B STUDY
KULITE DATA



NASA V/B STUDY KULITE DATA

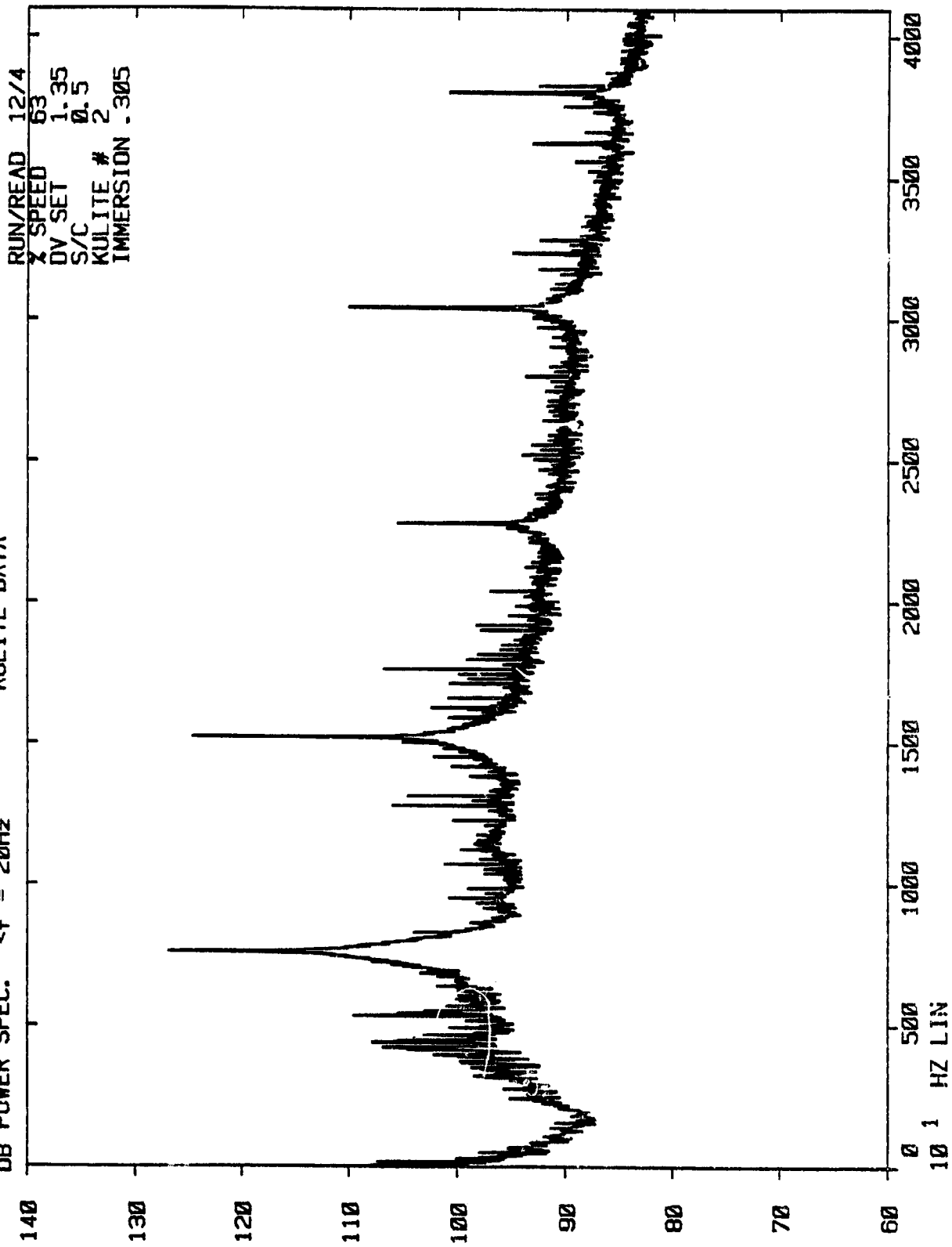
DB POWER SPEC. $\Delta f = 20\text{Hz}$

RUN/READ 12/28
X SPEED 63
DV SET 1.35
S/C 0.5
KULITE # 4
IMMERSION .0248



NASA V/B STUDY
KULITE DATA

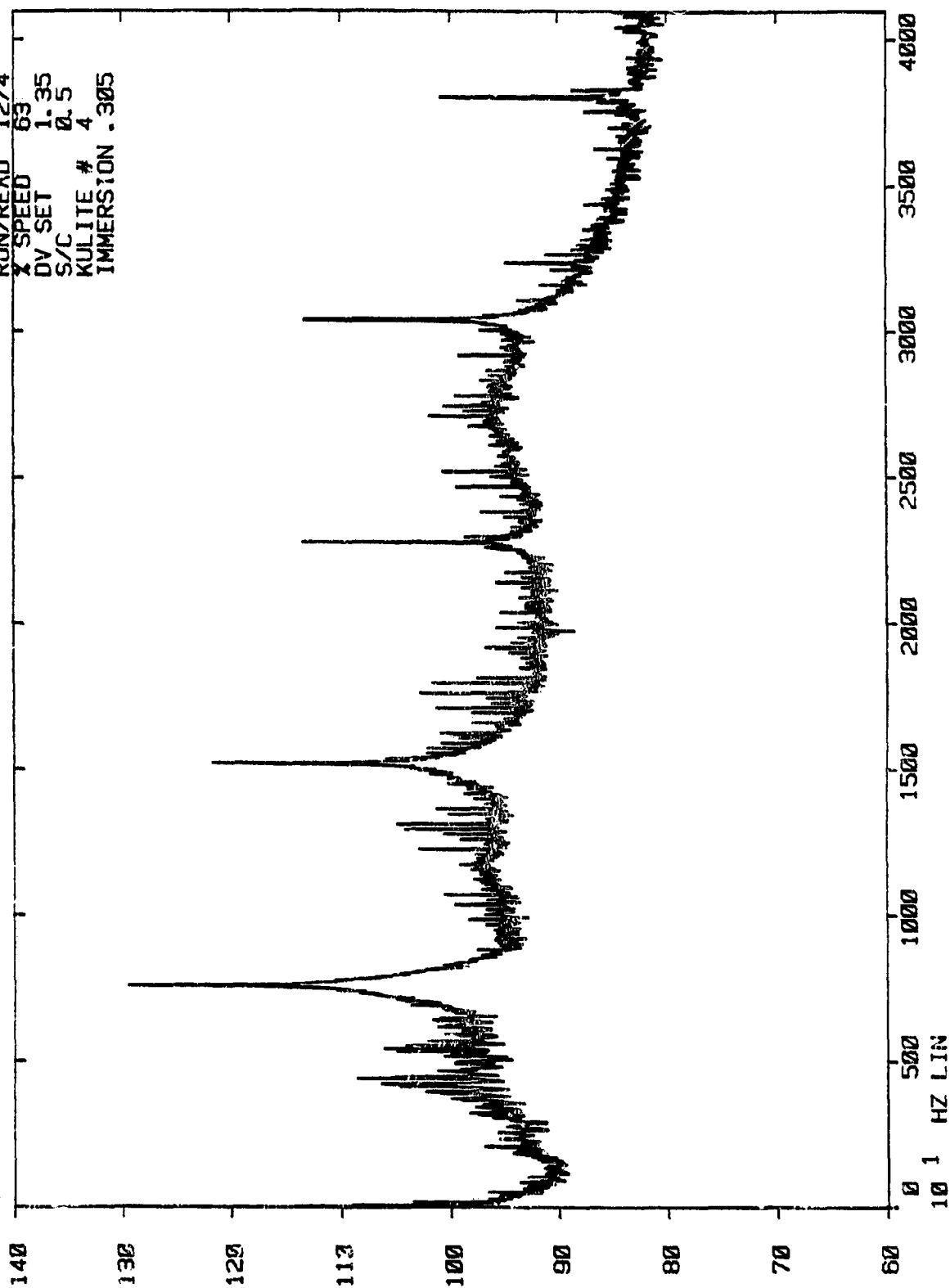
DB POWER SPEC. $\Delta f = 20\text{Hz}$



NASA V/B STUDY KULITE DATA

DB POWER SPEC. $\langle f = 20\text{Hz} \rangle$

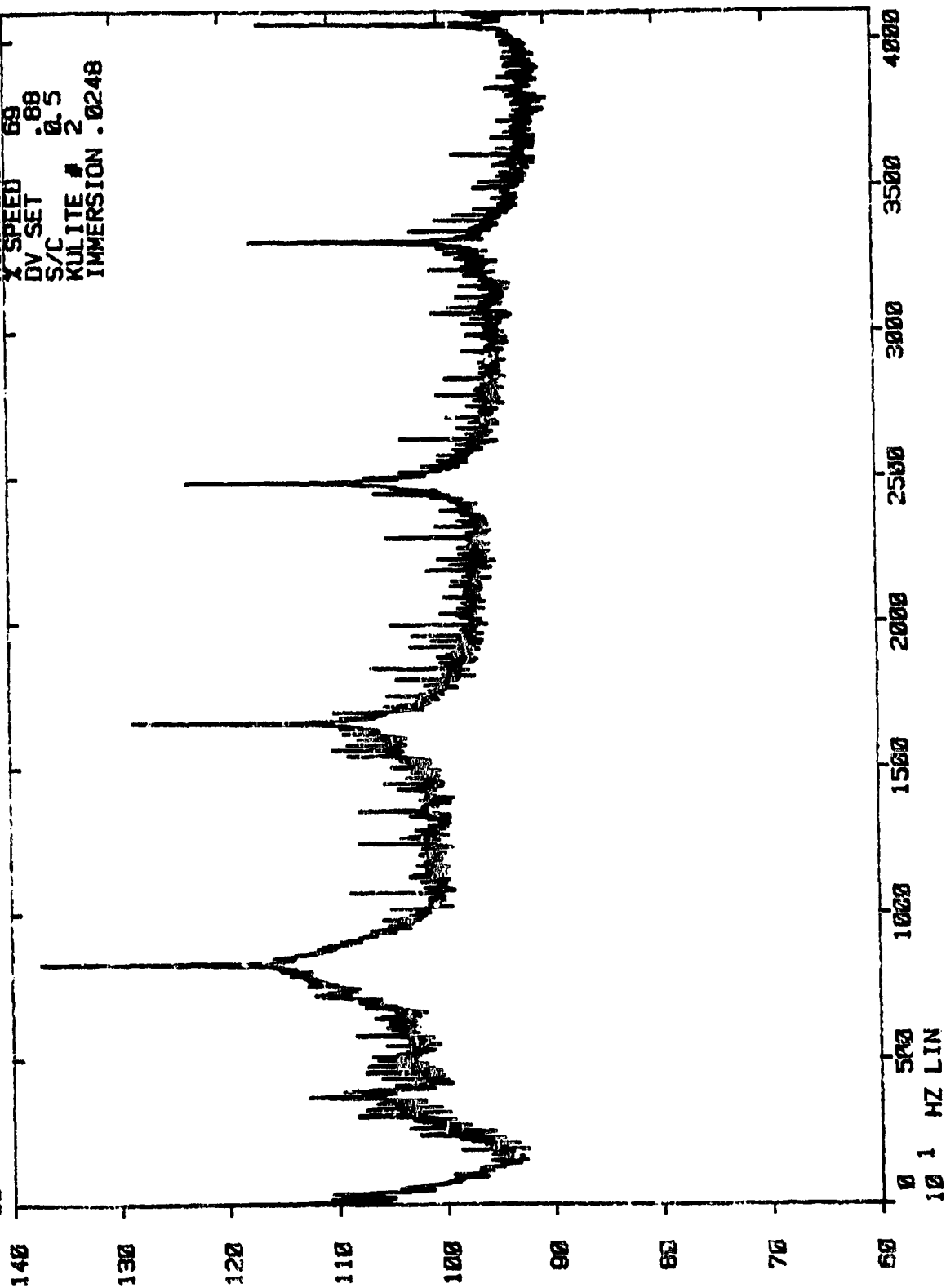
RUN/READ 12/4
SPEED 63
DV SET 1.35
S/C 0.5
KULITE # 4
IMMERSION .305

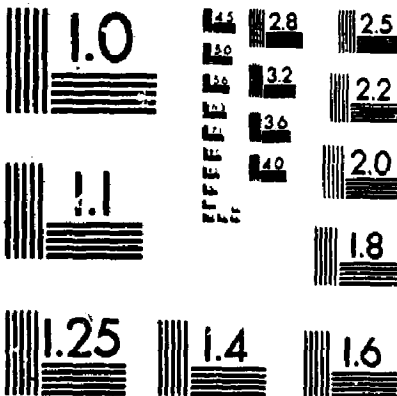


NASA V/B STUDY KULITE DATA

DB POWER SPEC. $< f = 20\text{Hz}$

RUN/READ 12/26
X SPEED 69
DV SET .88
S/C 0.5
KULITE # 2
IMMERSION .0248



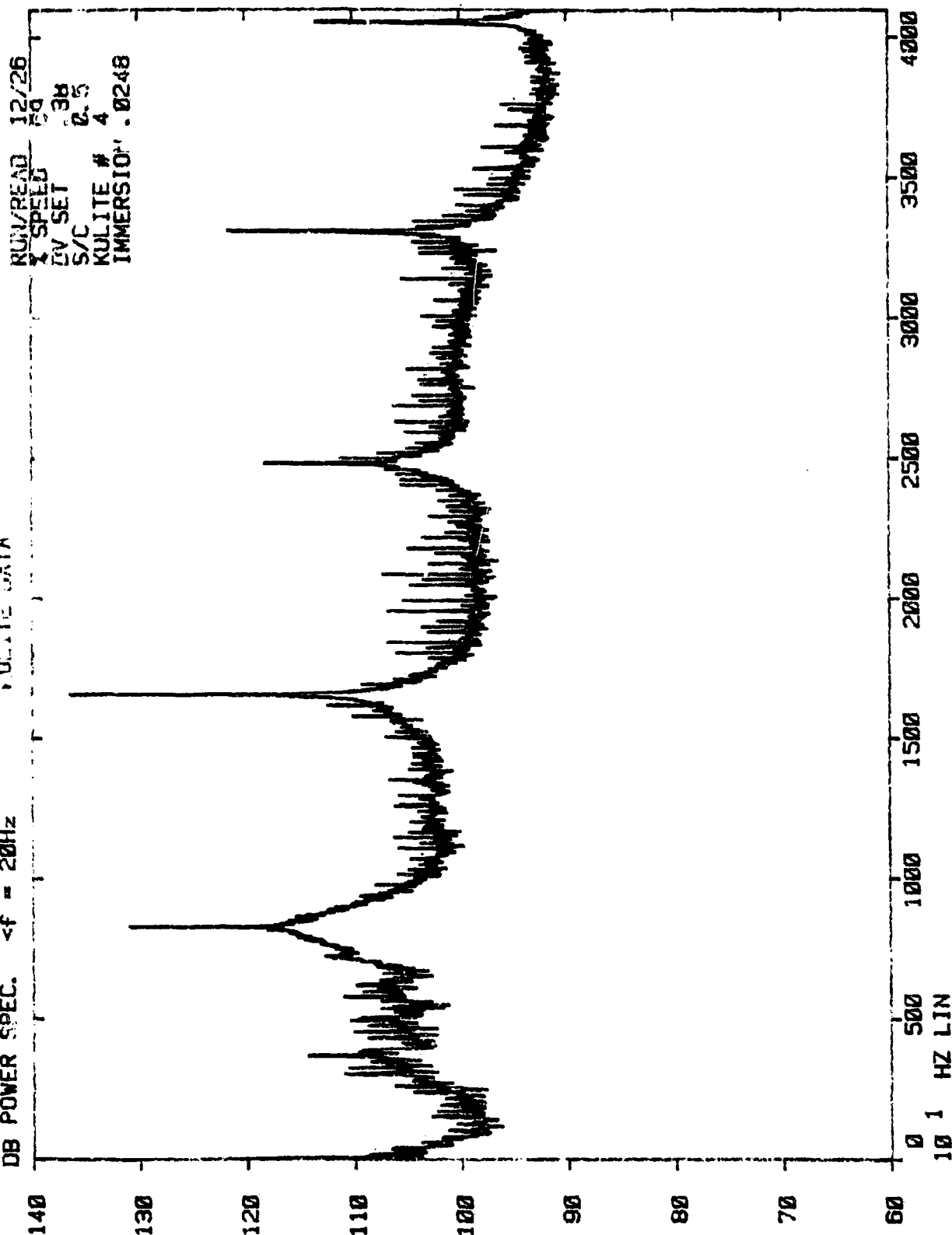


MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS
STANDARD REFERENCE MATERIAL 1010a
(ANSI and ISO TEST CHART No. 2)



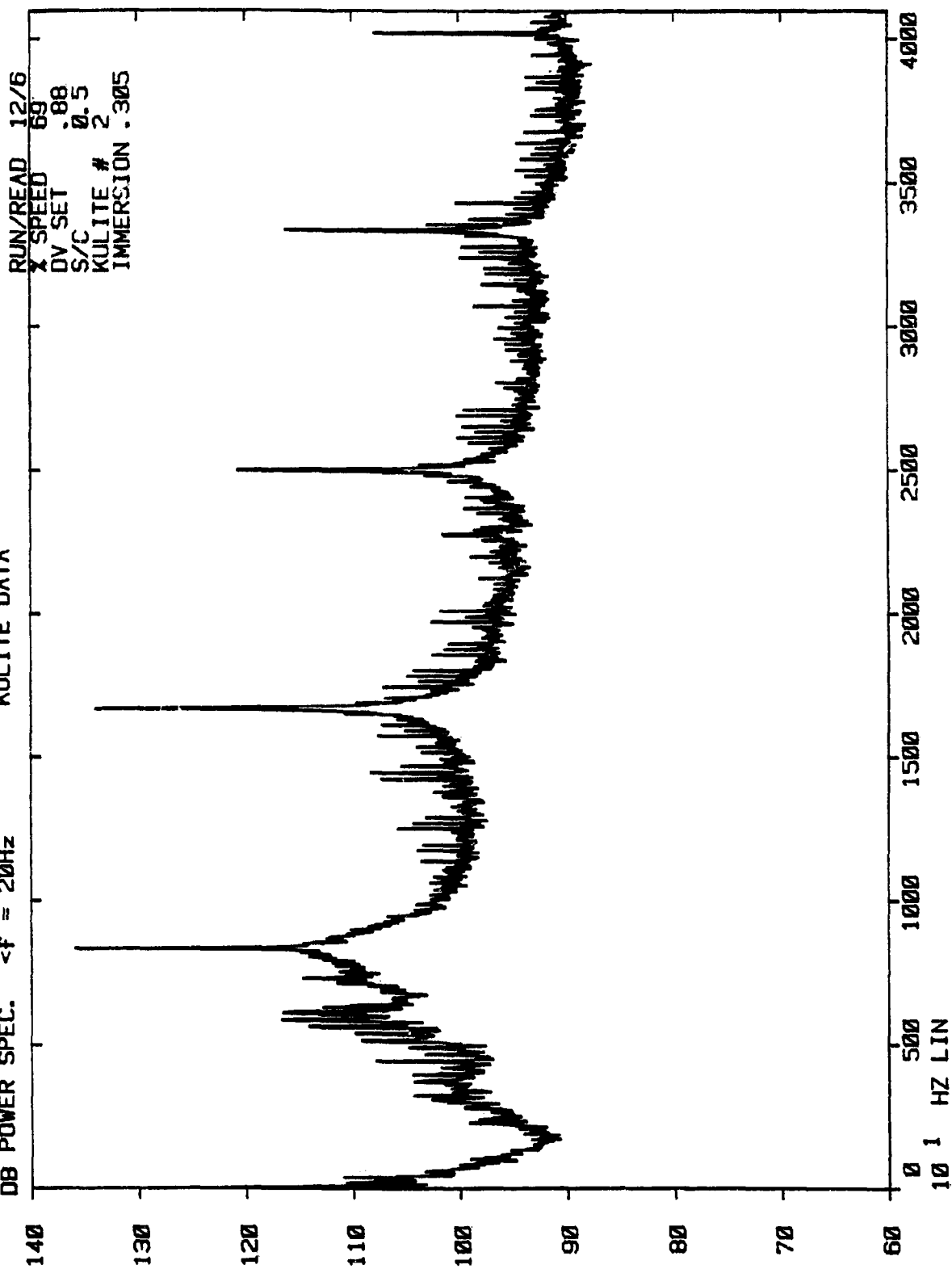
NASA V2B STUDY KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$



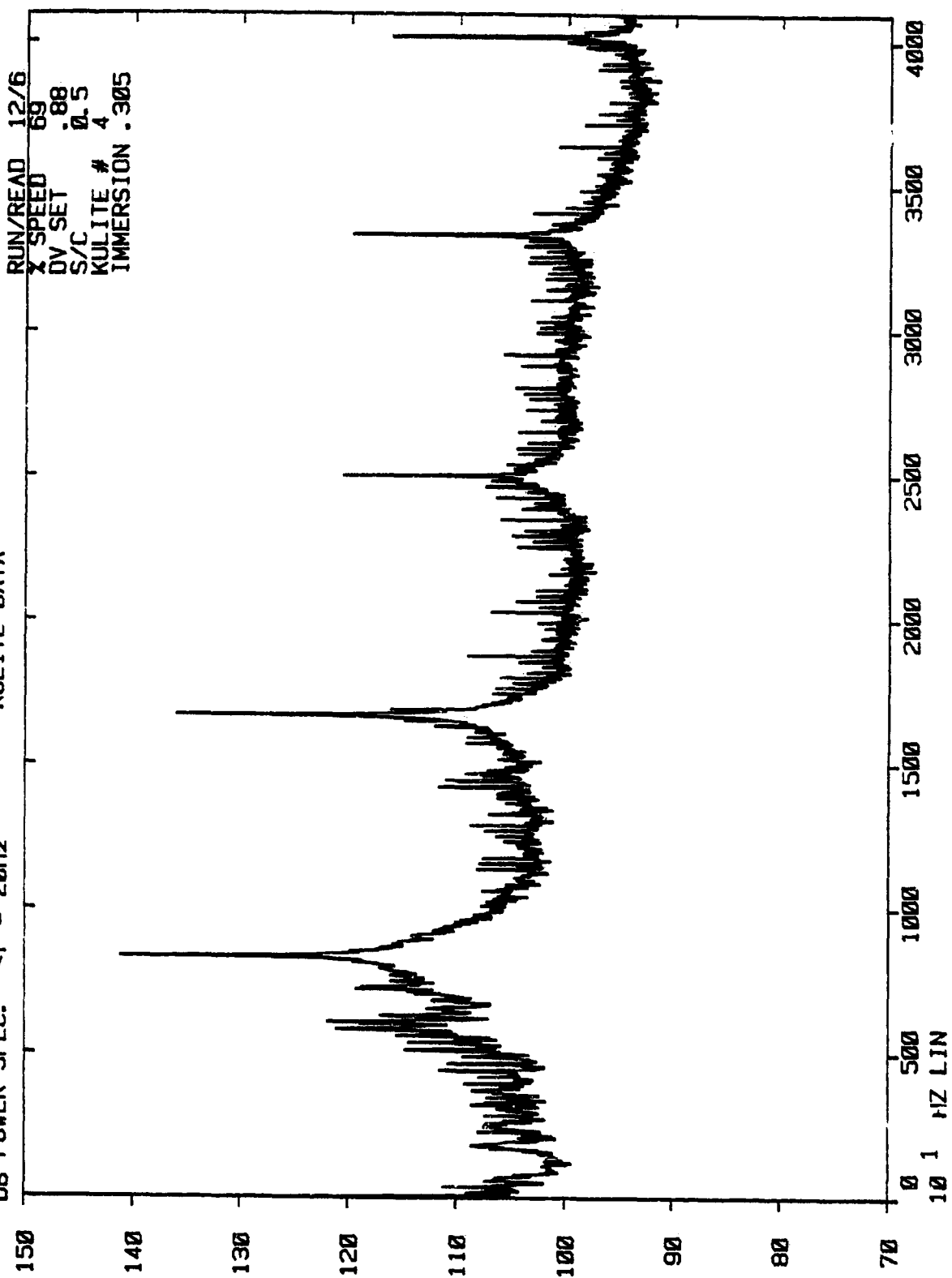
NASA V/B STUDY
KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$



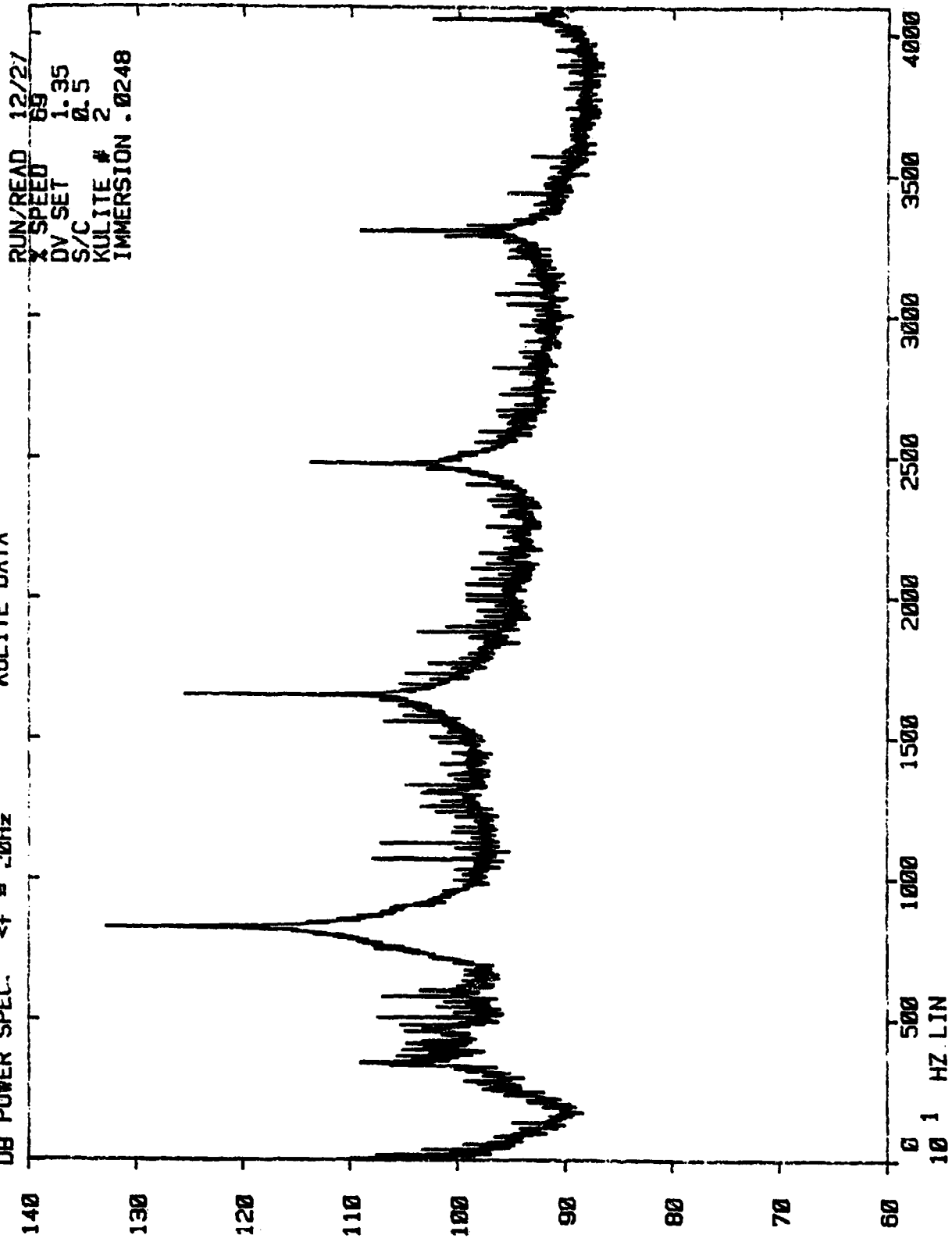
NASA V/B STUDY
KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$



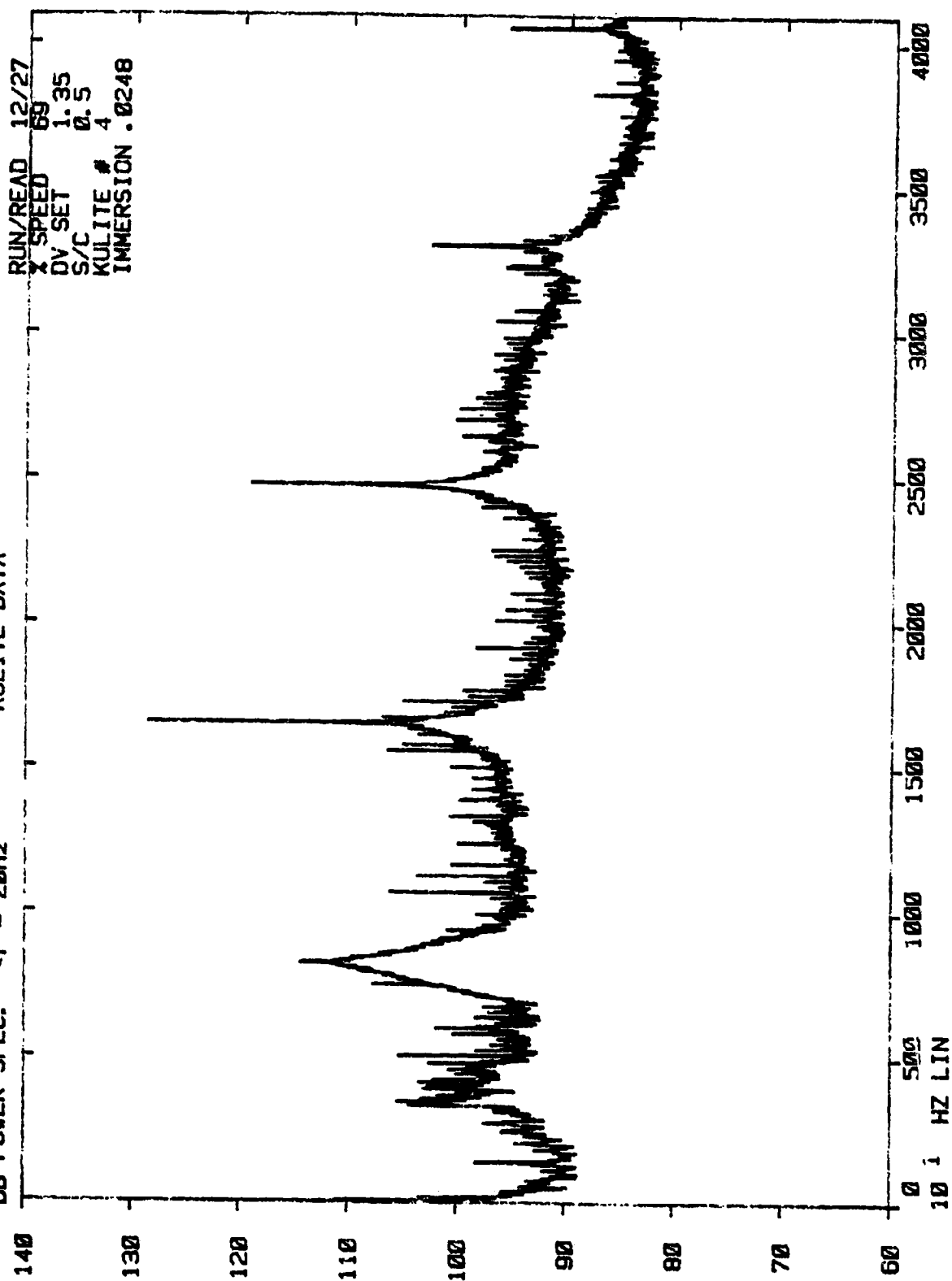
NASA V/B STUDY
KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$



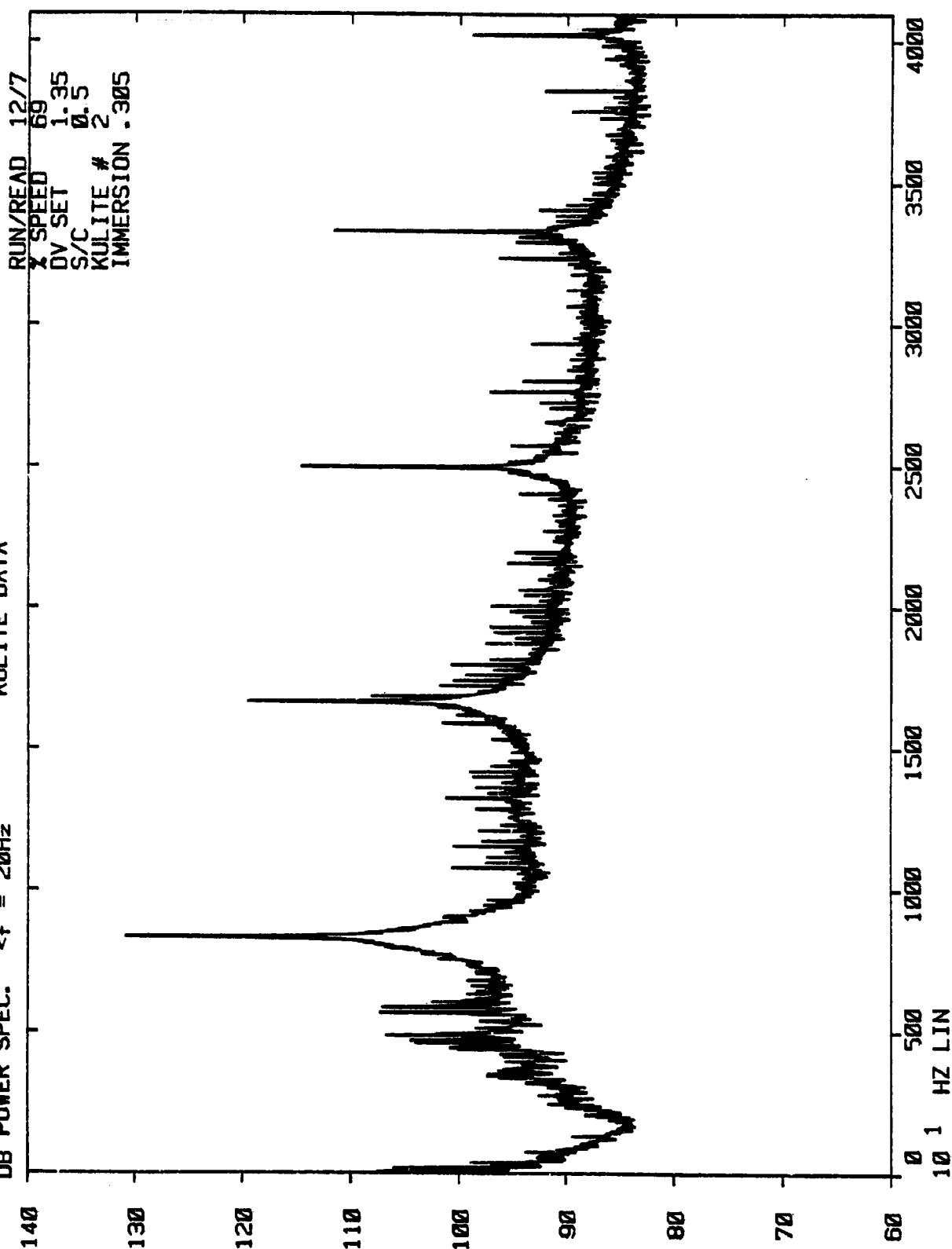
NASA V/B STUDY KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$



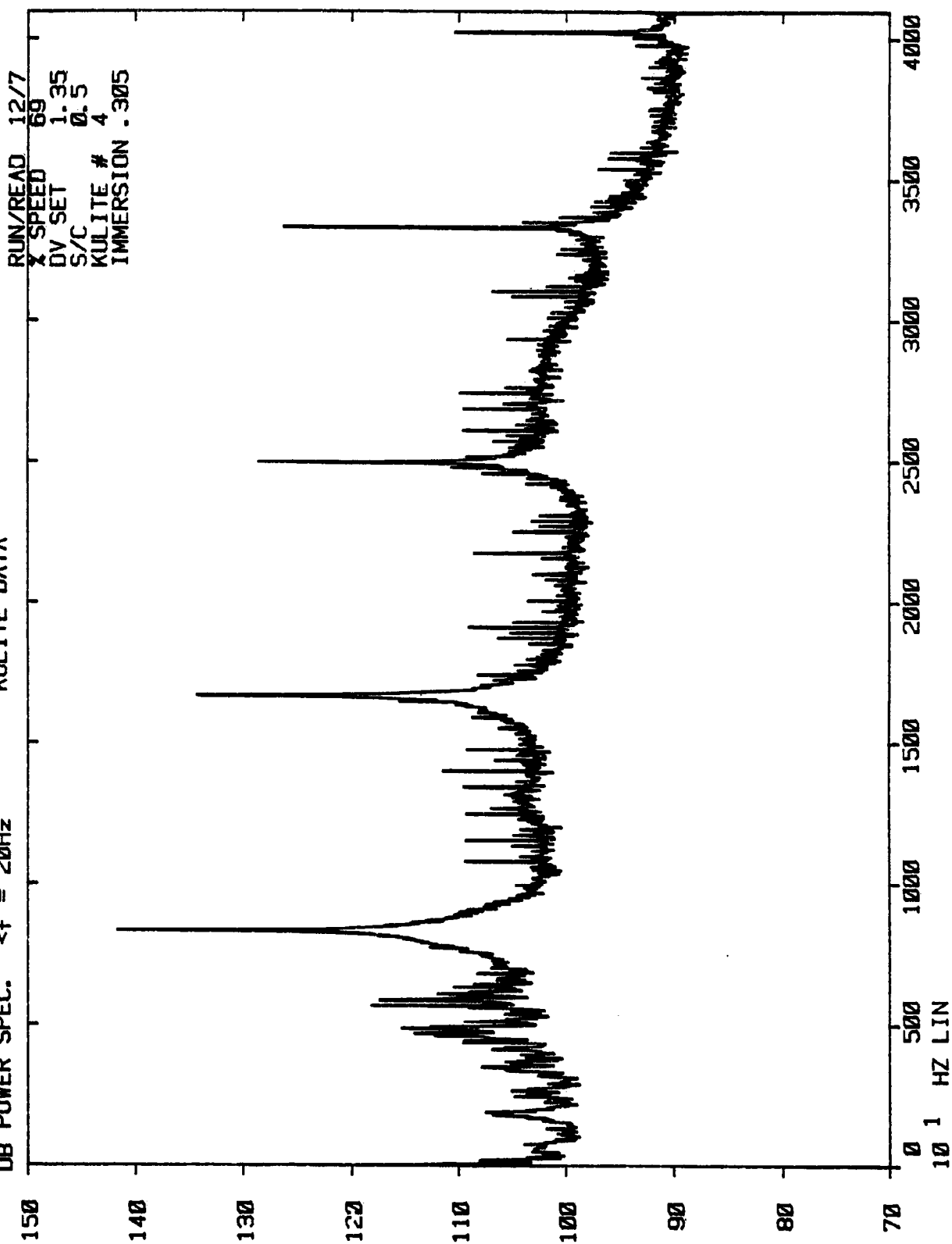
NASA V/B STUDY KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$

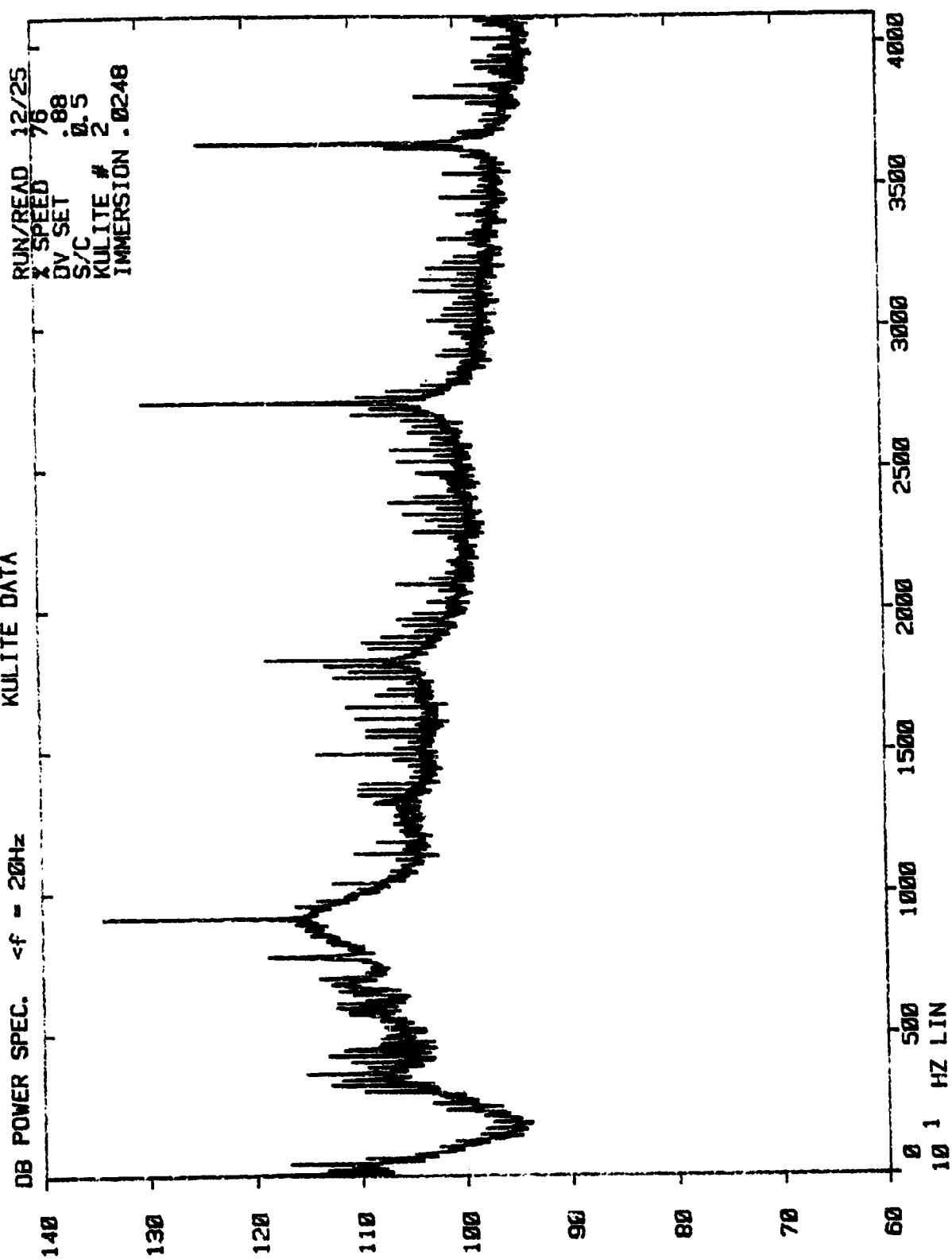


NASA V/B STUDY KULITE DATA

DB POWER SPEC. $<f = 20\text{Hz}$

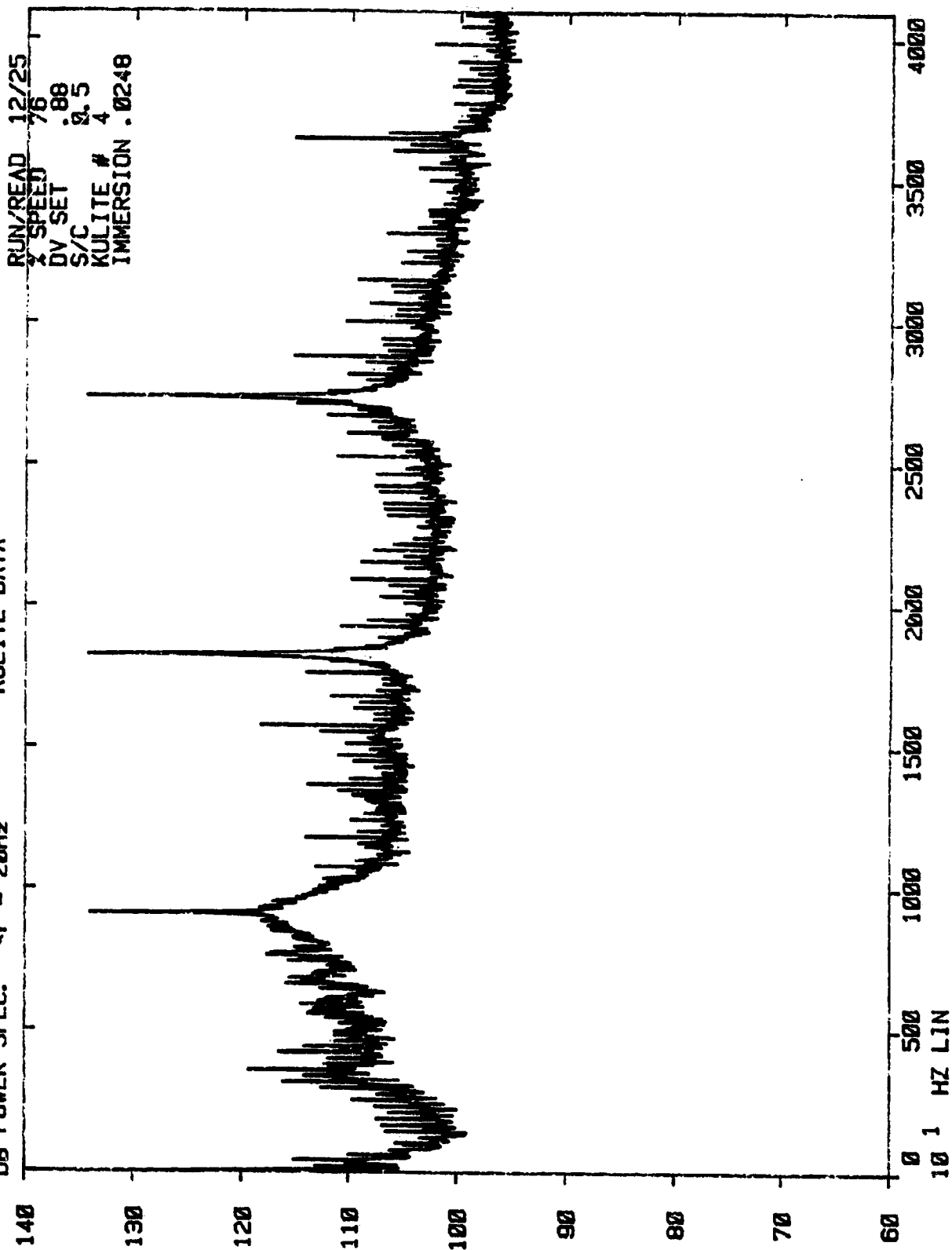


NASA V/B STUDY
KULITE DATA

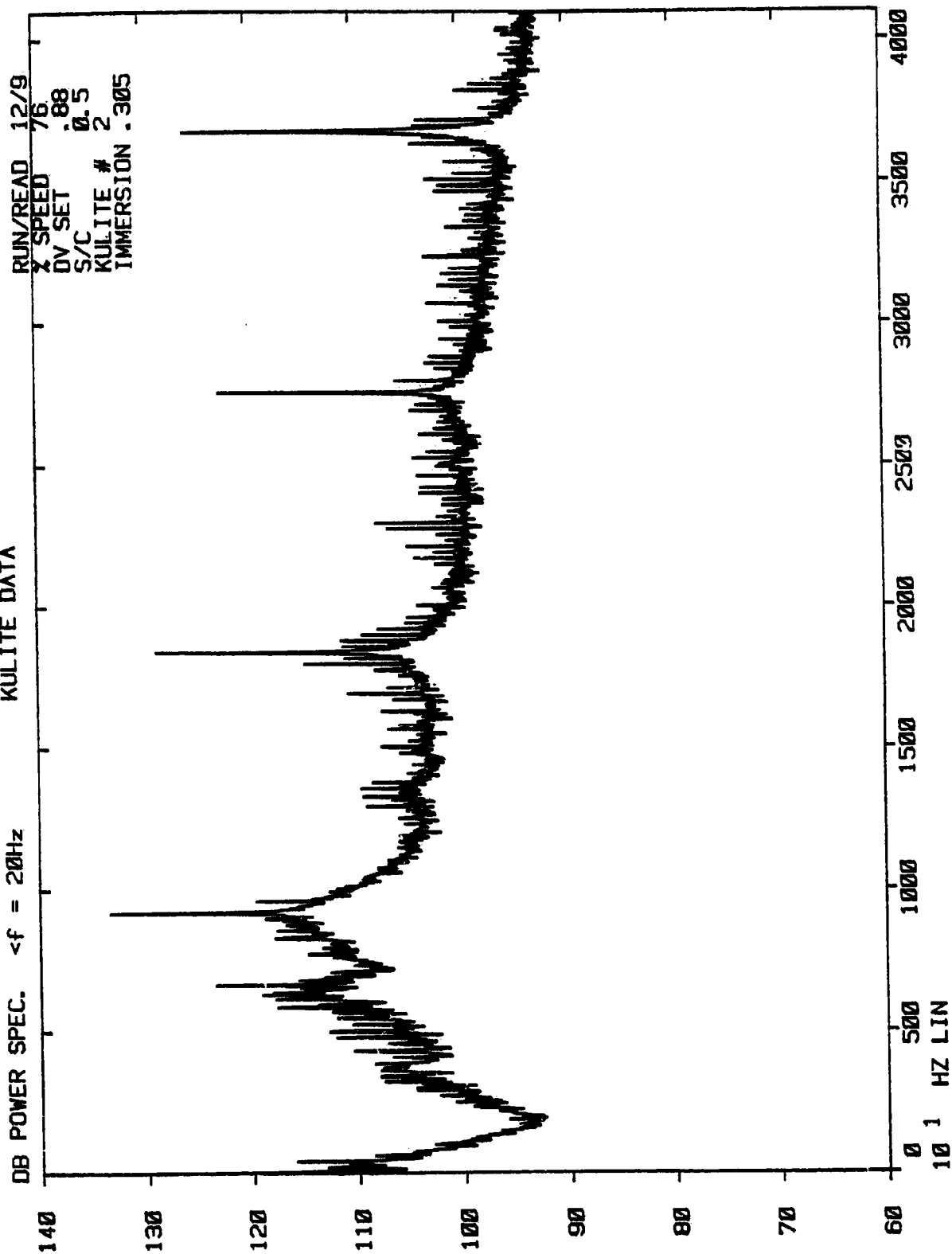


NASA V/B STUDY
KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$



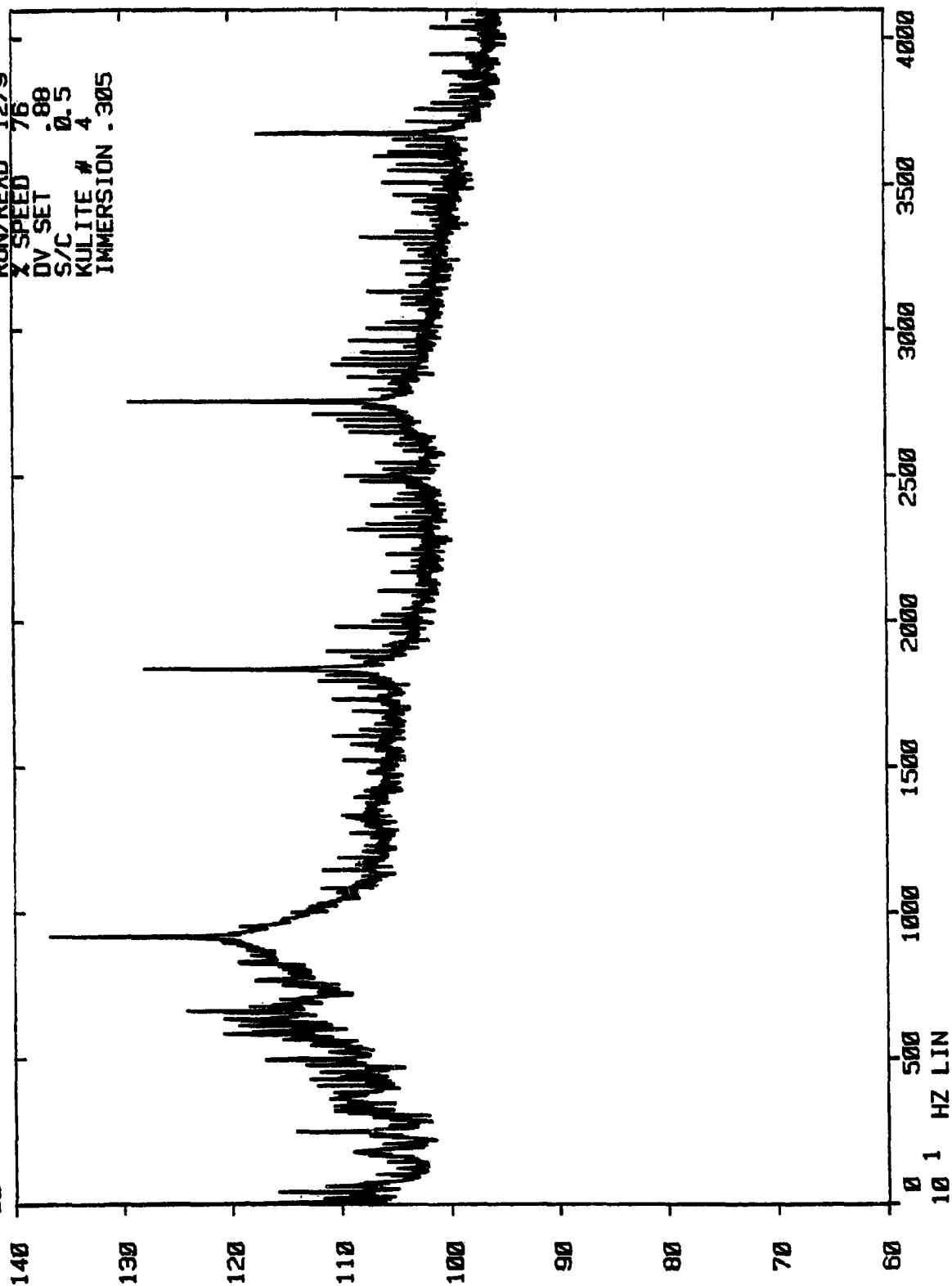
NASA V/B STUDY
KULITE DATA



NASA V/B STUDY
KULITE DATA

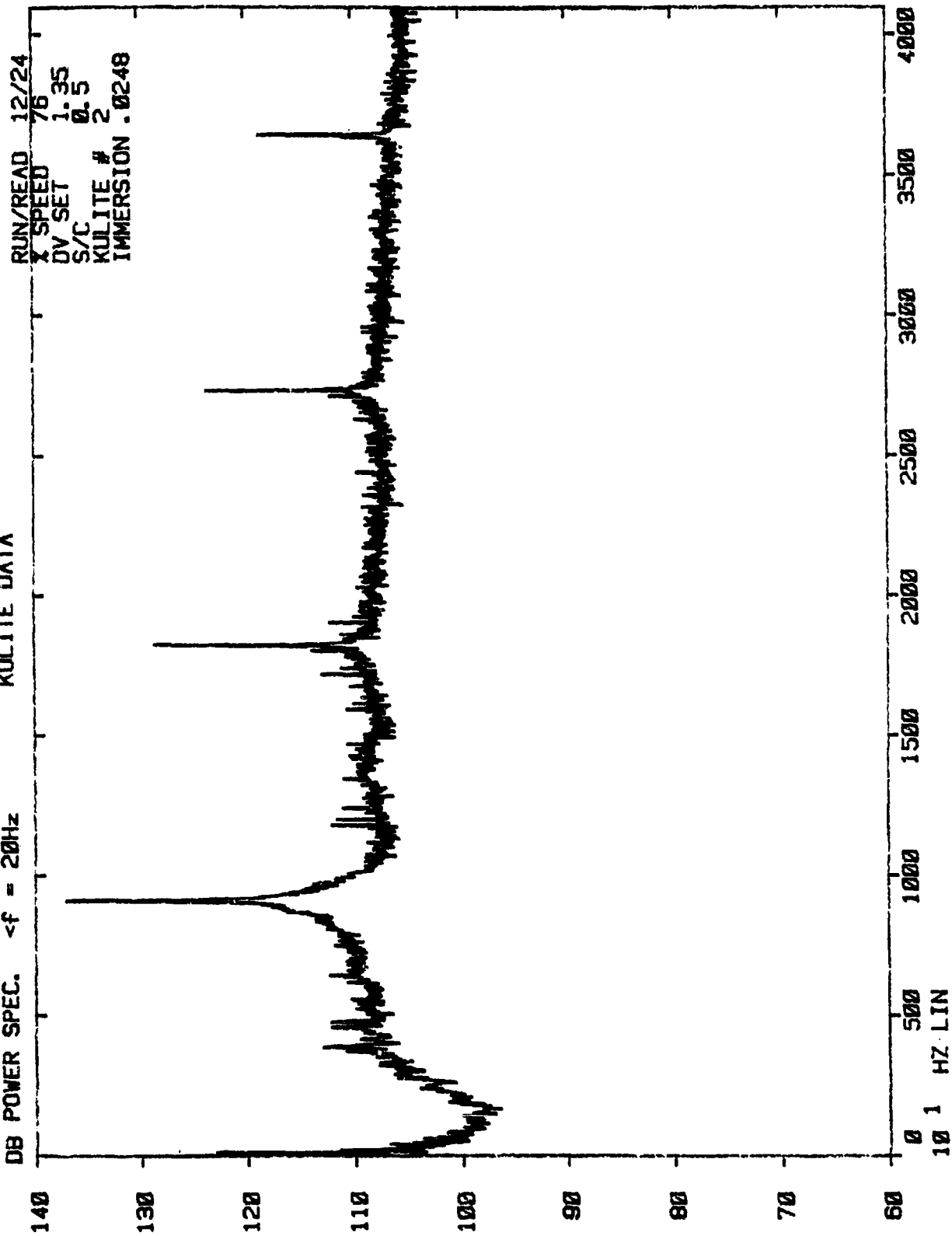
DB POWER SPEC. $< f = 20\text{Hz}$

RUN/READ 12/9
X SPEED 76
DV SET .88
S/C 0.5
KULITE # 4
IMMERSION .305



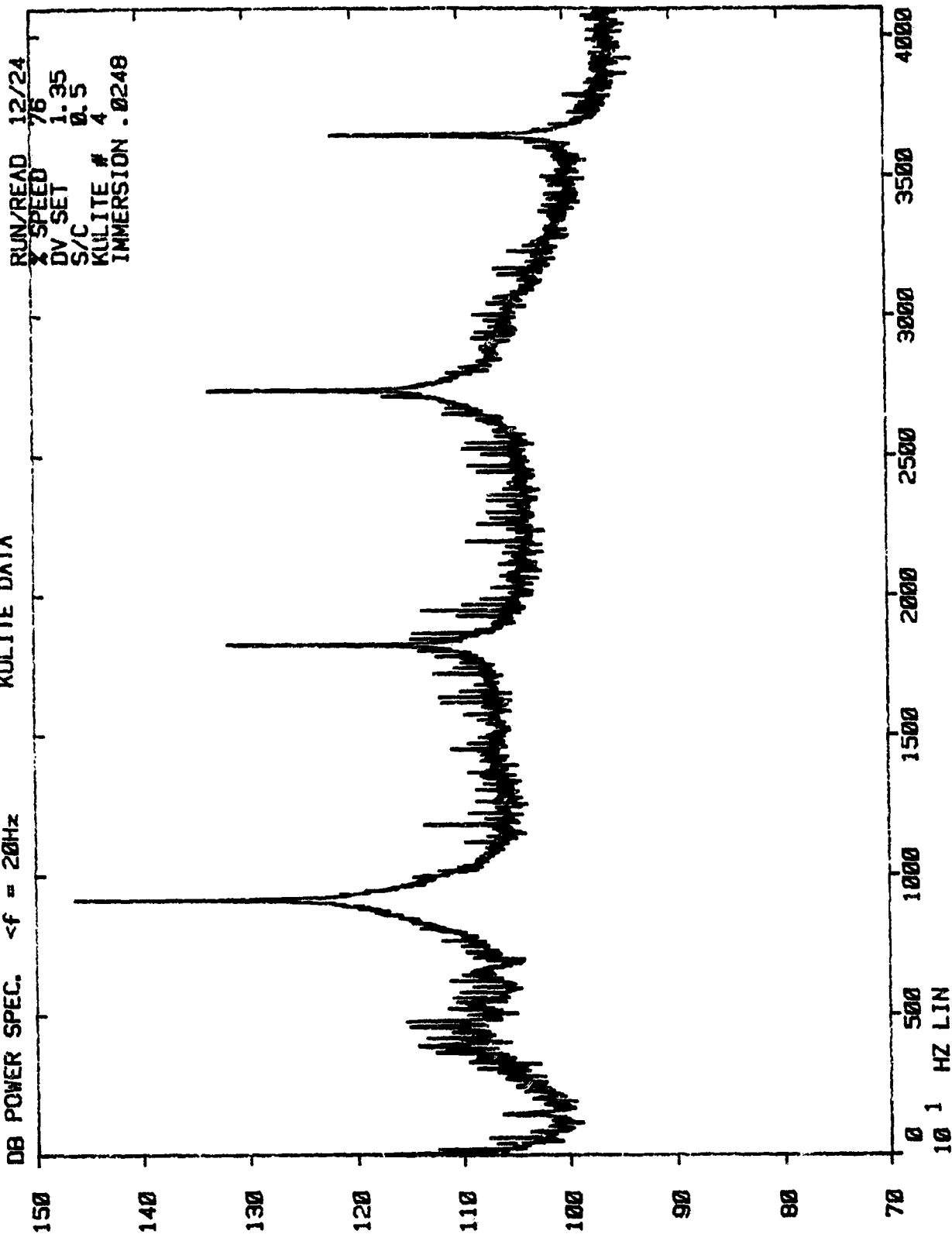
NASA V/B STUDY
KULITE DATA

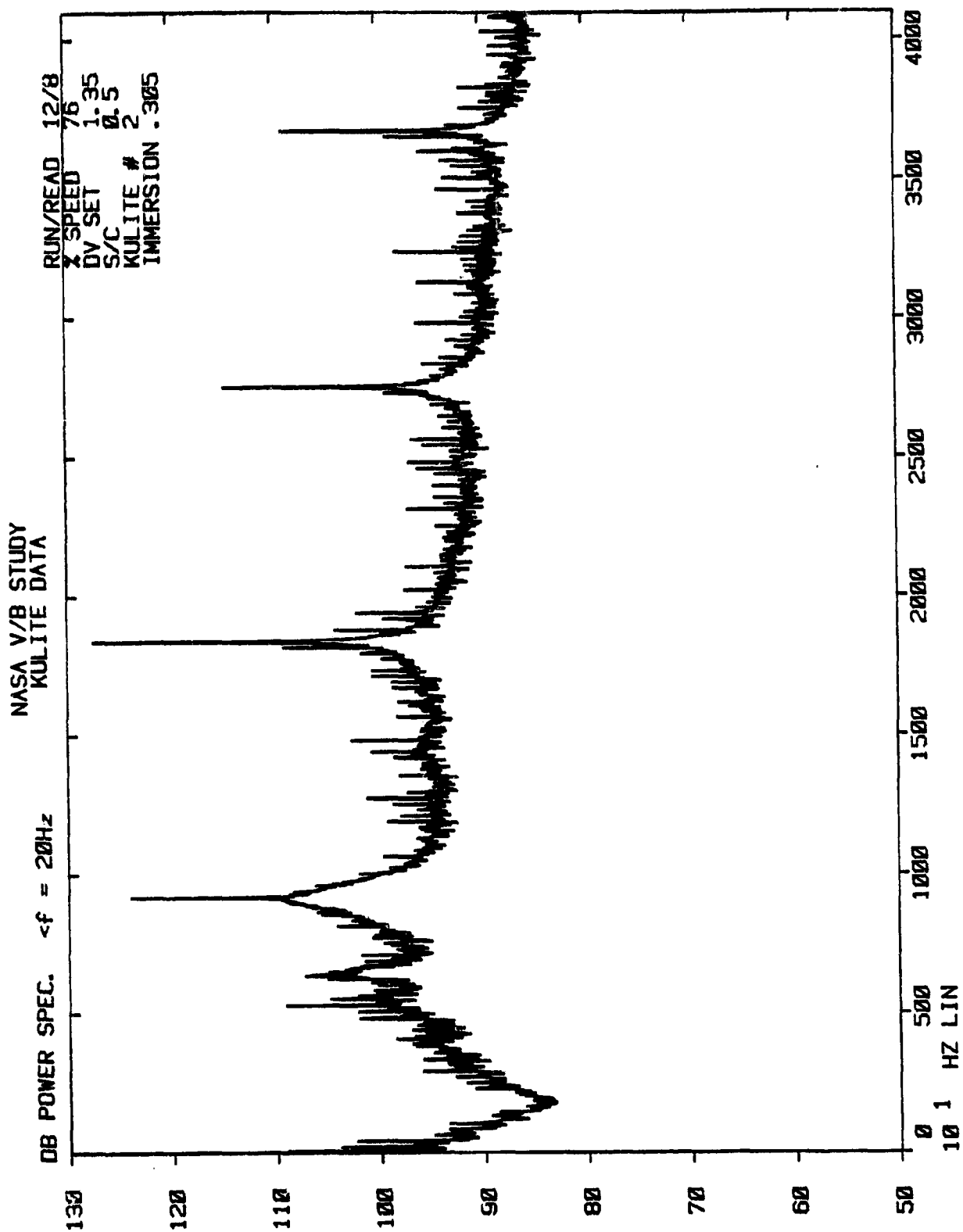
DB POWER SPEC. $< f = 20\text{Hz}$



NASA V/B STUDY KULITE DATA

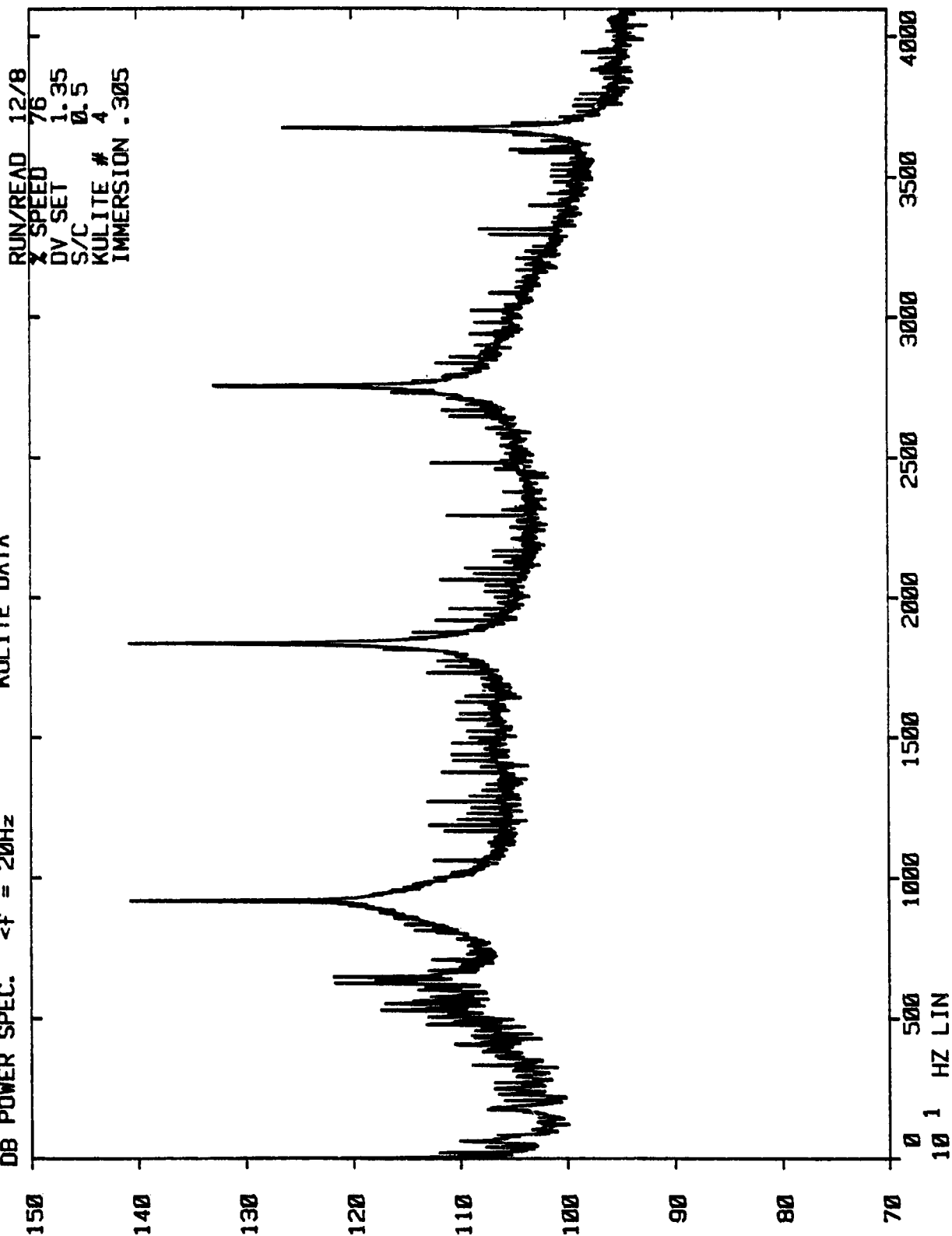
DB POWER SPEC. $<f = 20\text{Hz}$





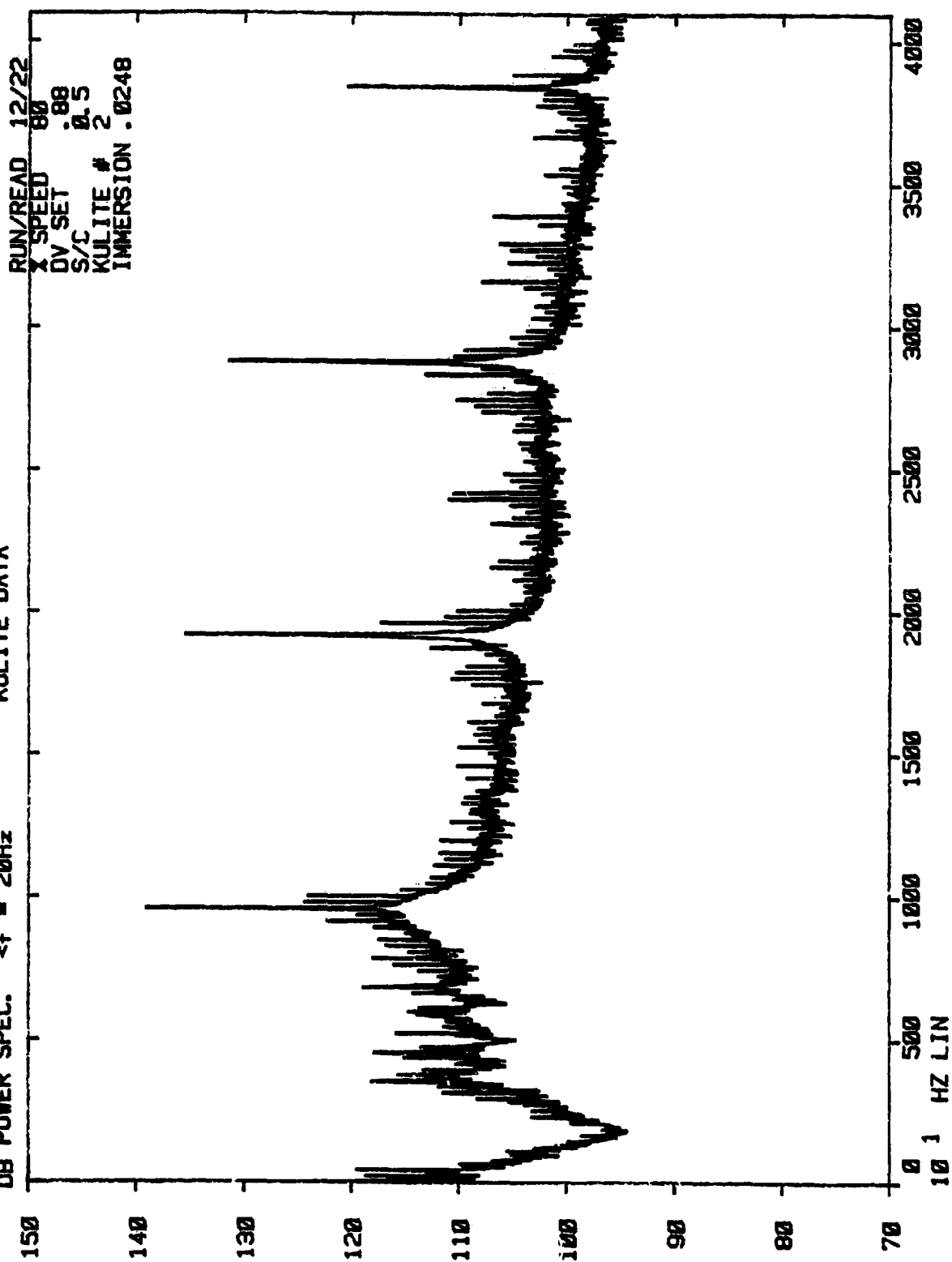
NASA V/B STUDY
KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$



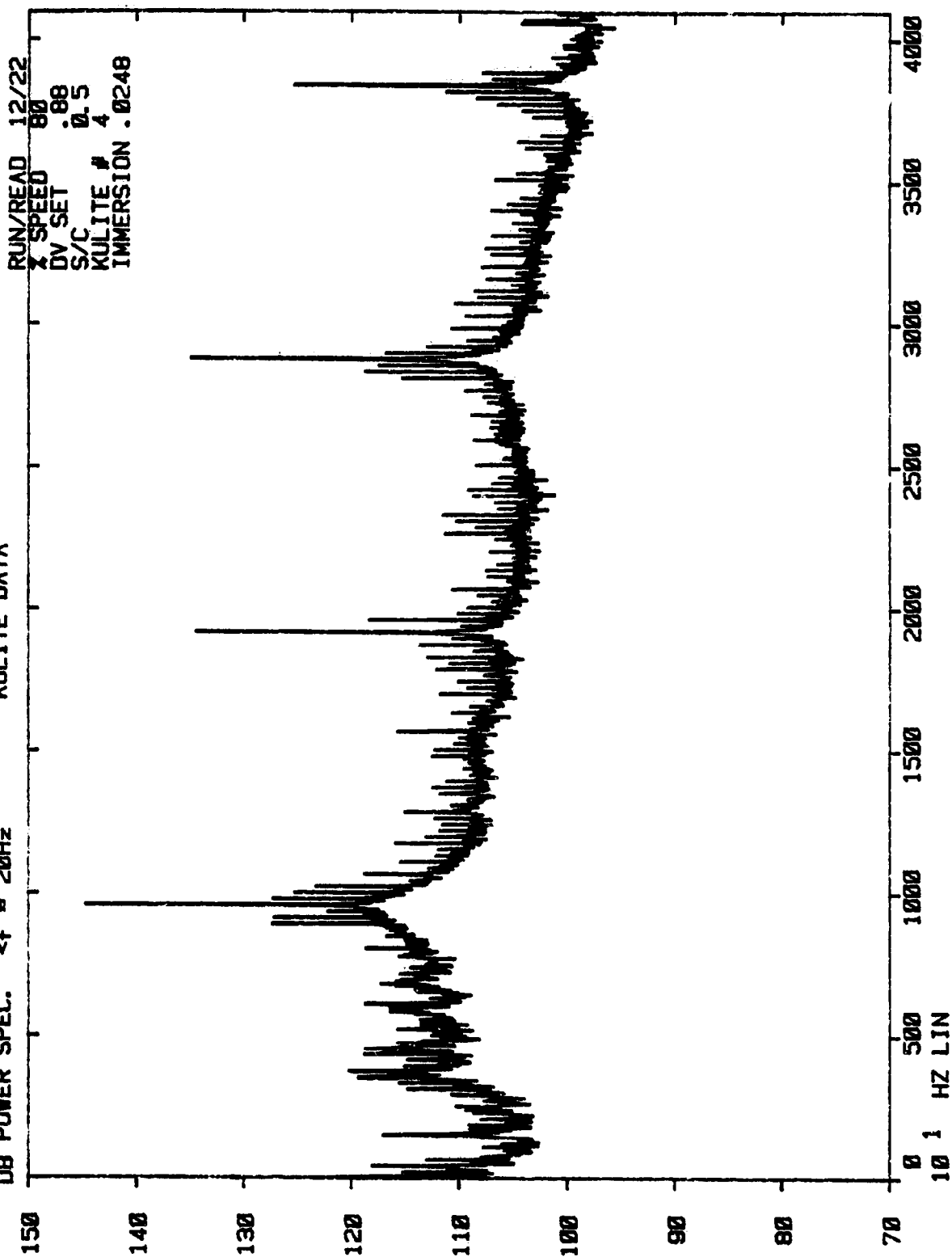
NASA V/B STUDY
KULITE DATA

DB POWER SPEC. $<f = 20\text{Hz}$

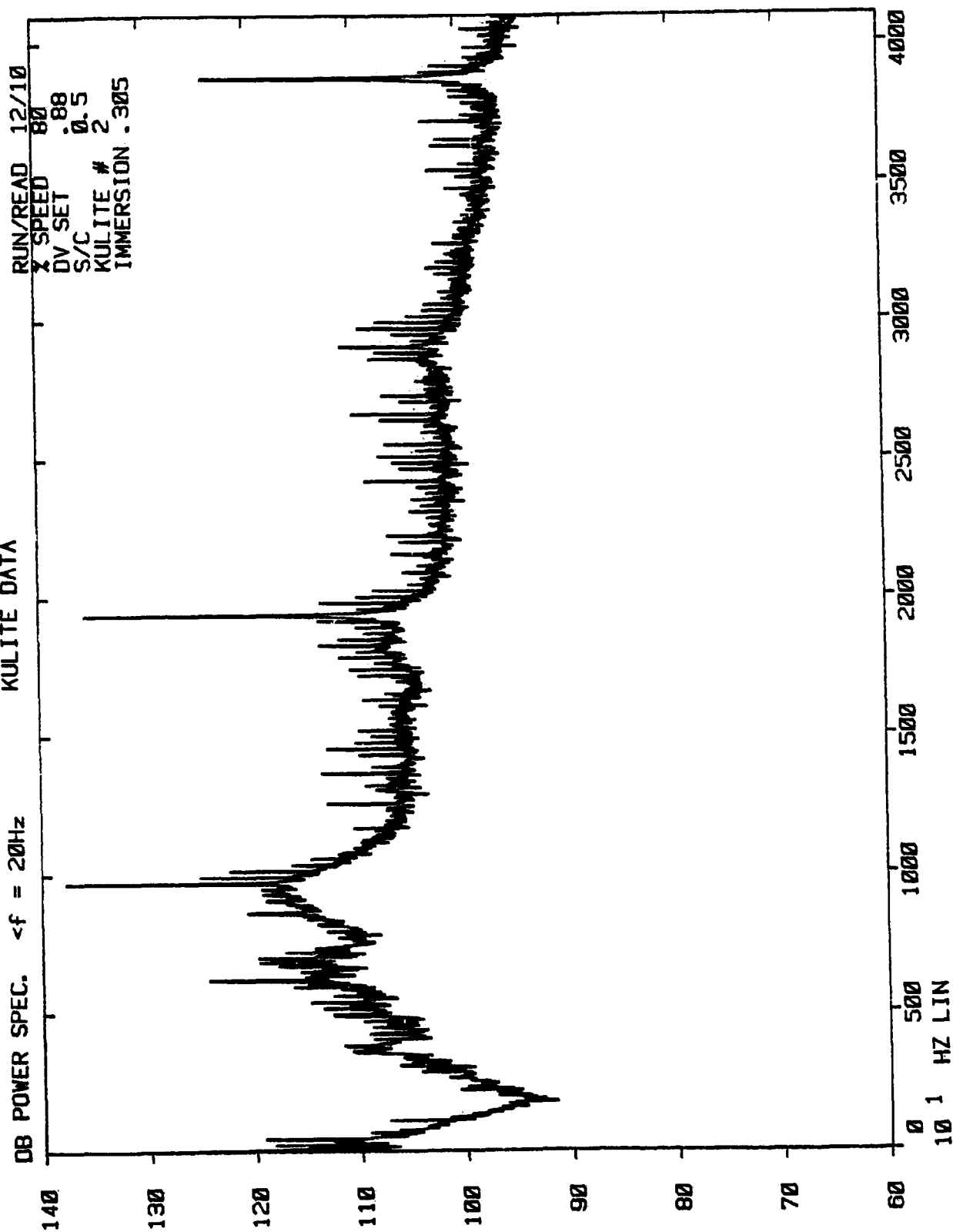


NASA V/B STUDY
KULITE DATA

DB POWER SPEC. $< f = 20\text{Hz}$

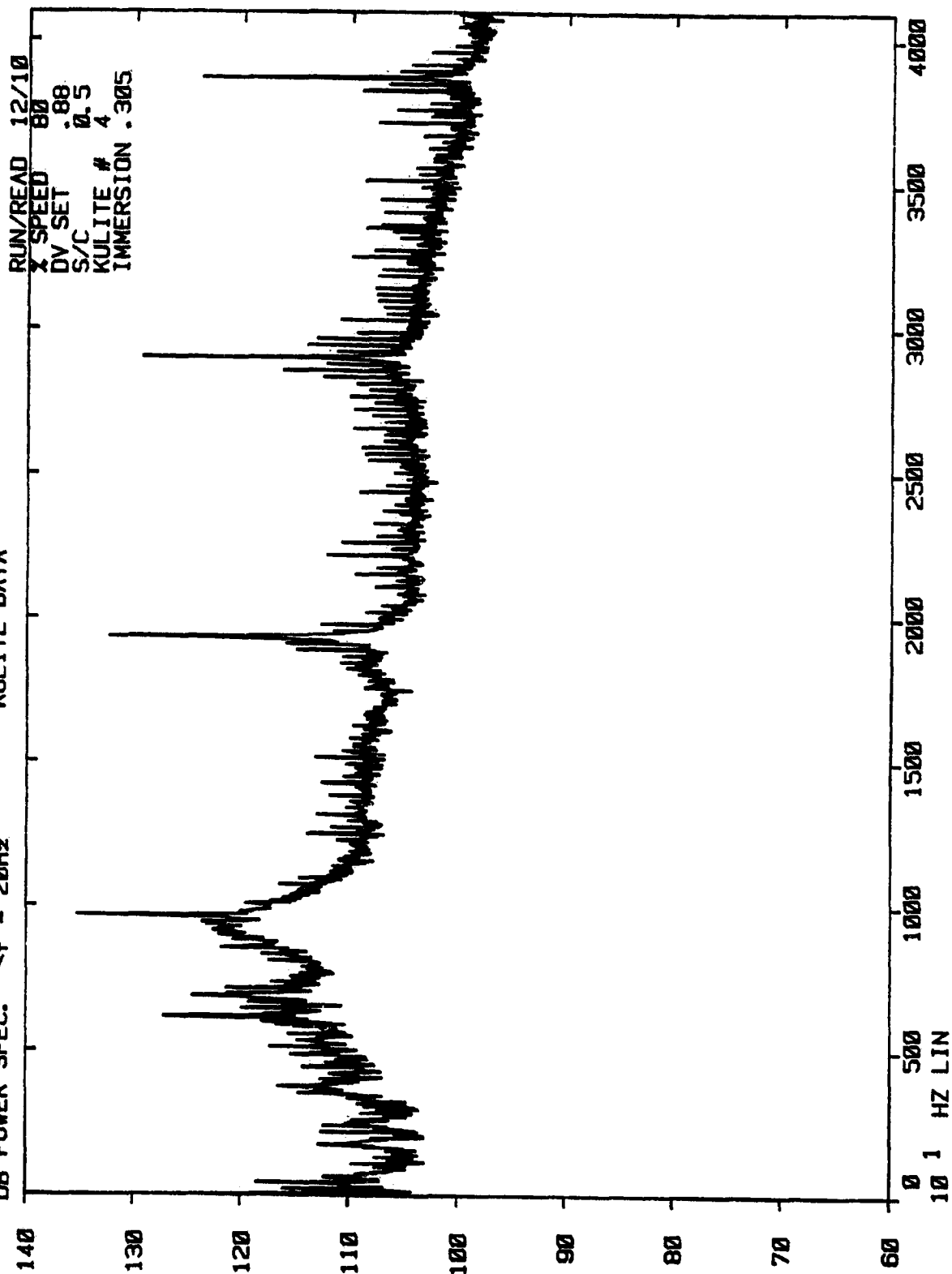


NASA V/B STUDY
KULITE DATA



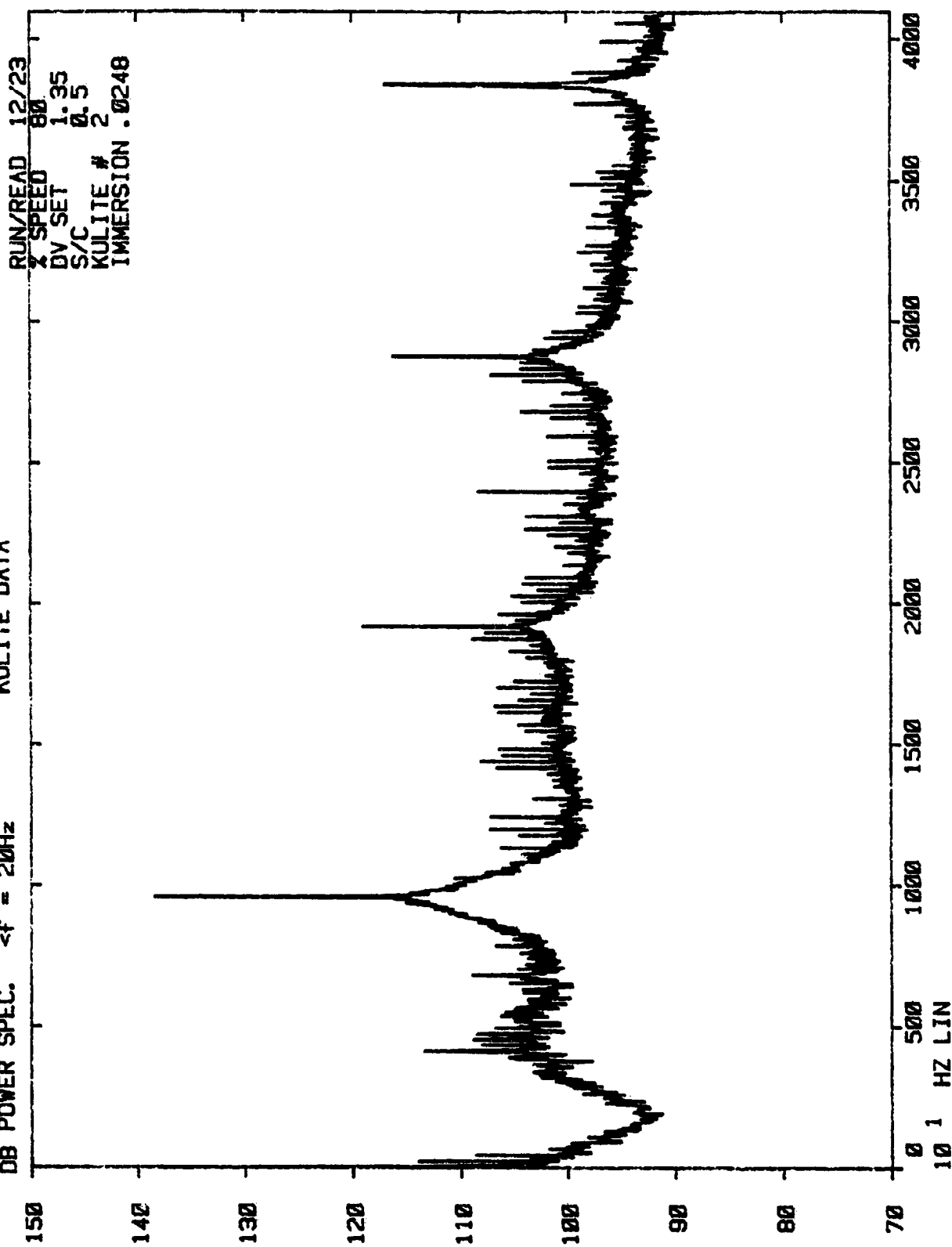
NASA V/B STUDY KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$



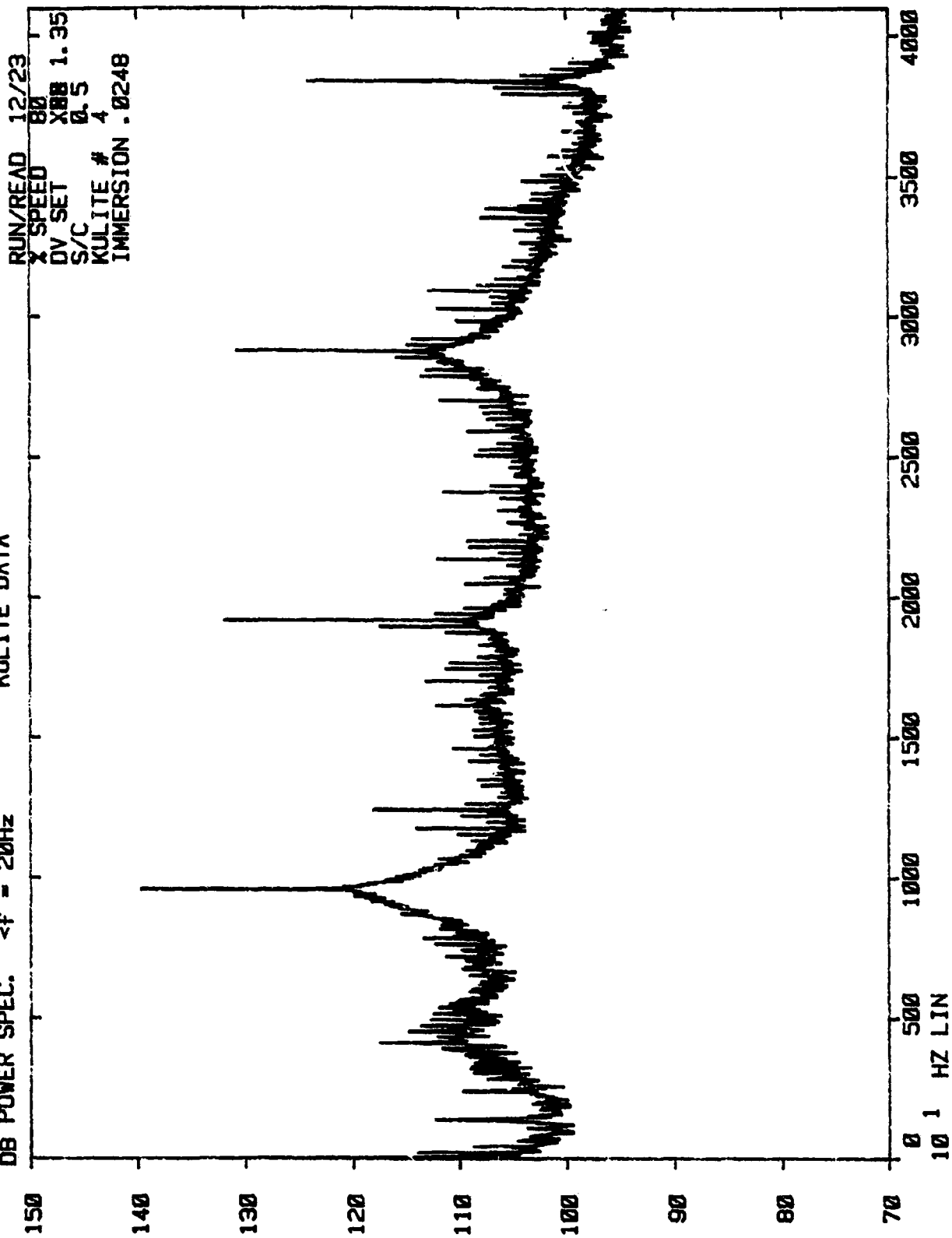
NASA V/B STUDY
KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$

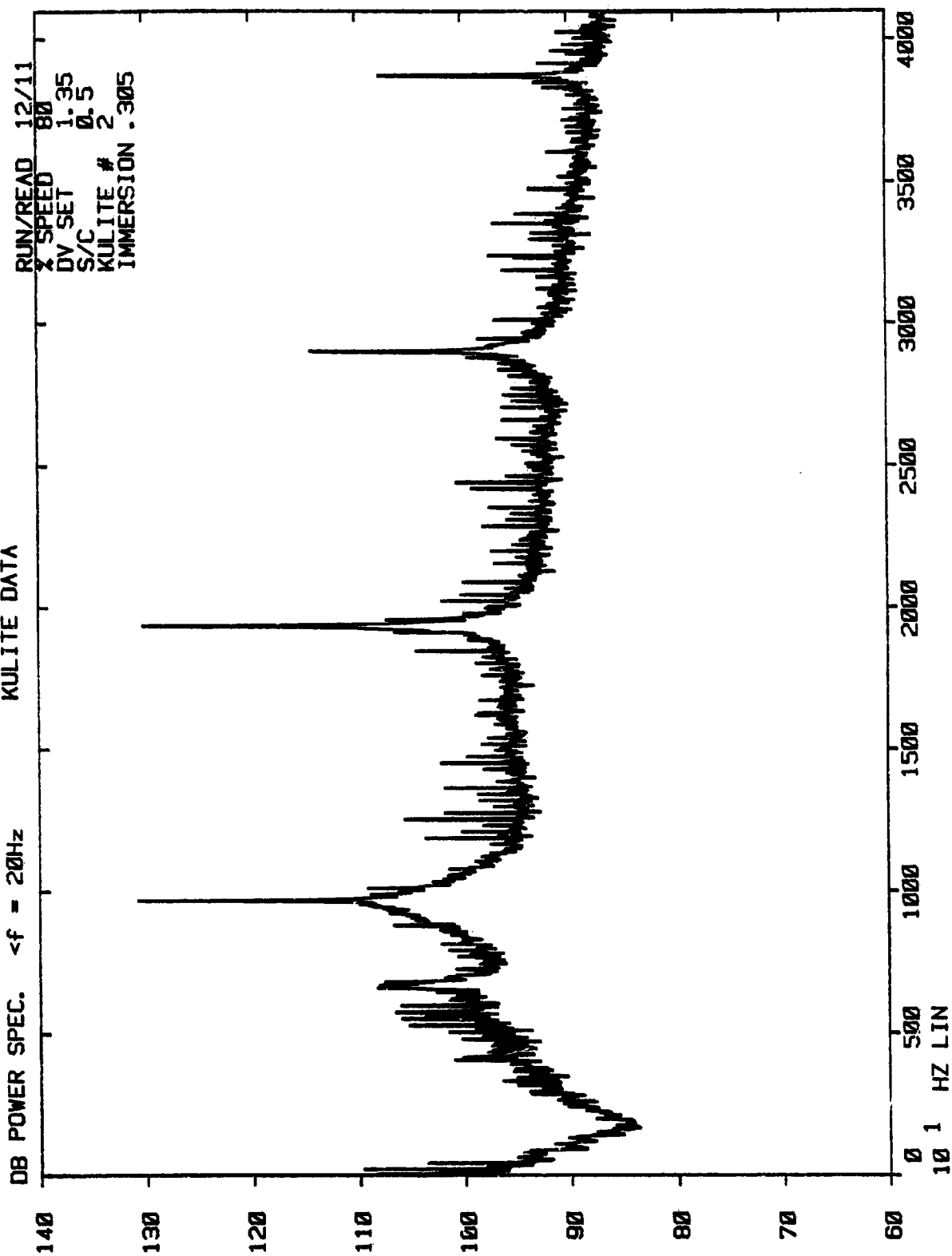


NASA V/B STUDY
KULITE DATA

DB POWER SPEC. $<f = 20\text{Hz}$

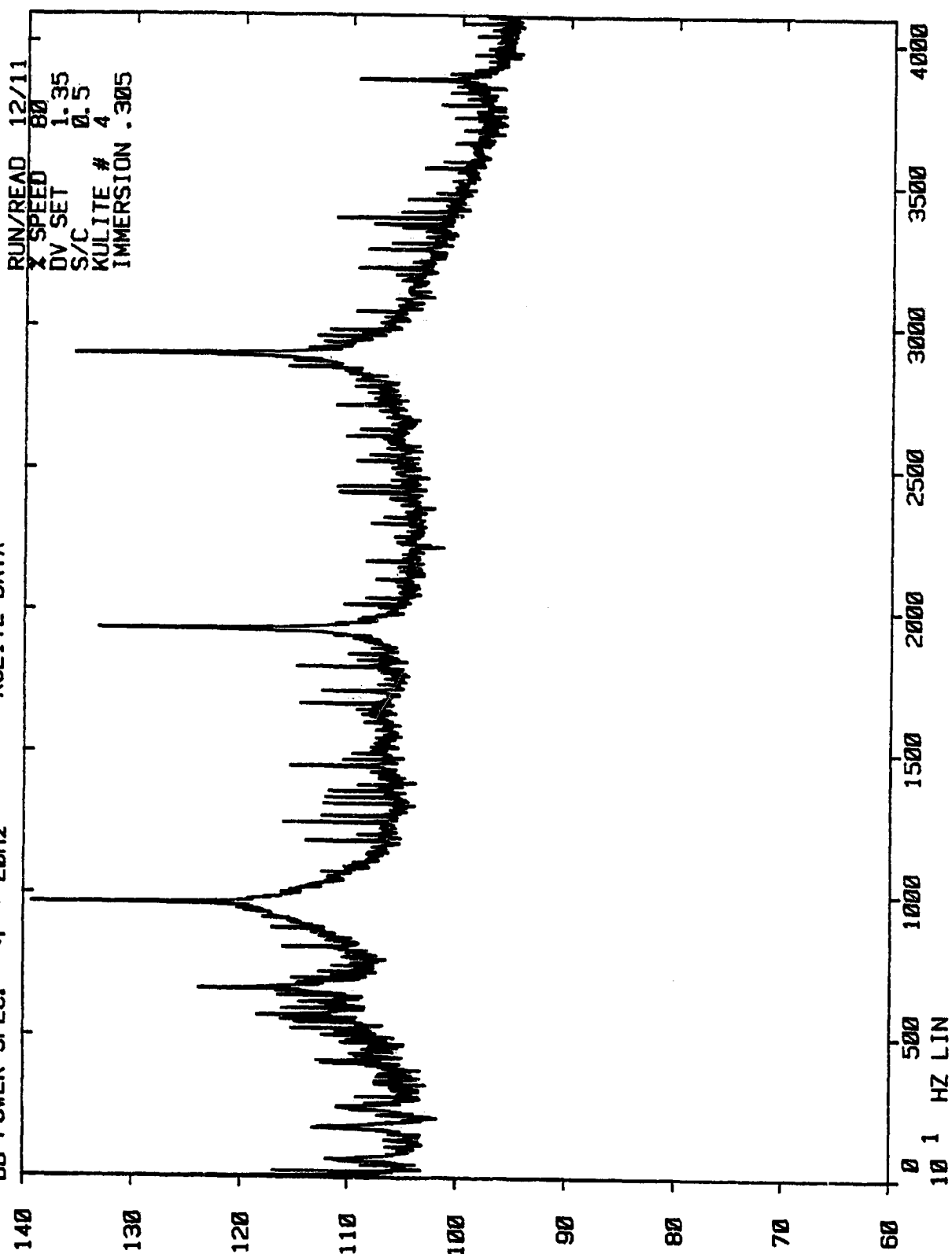


NASA V/B STUDY
KULITE DATA



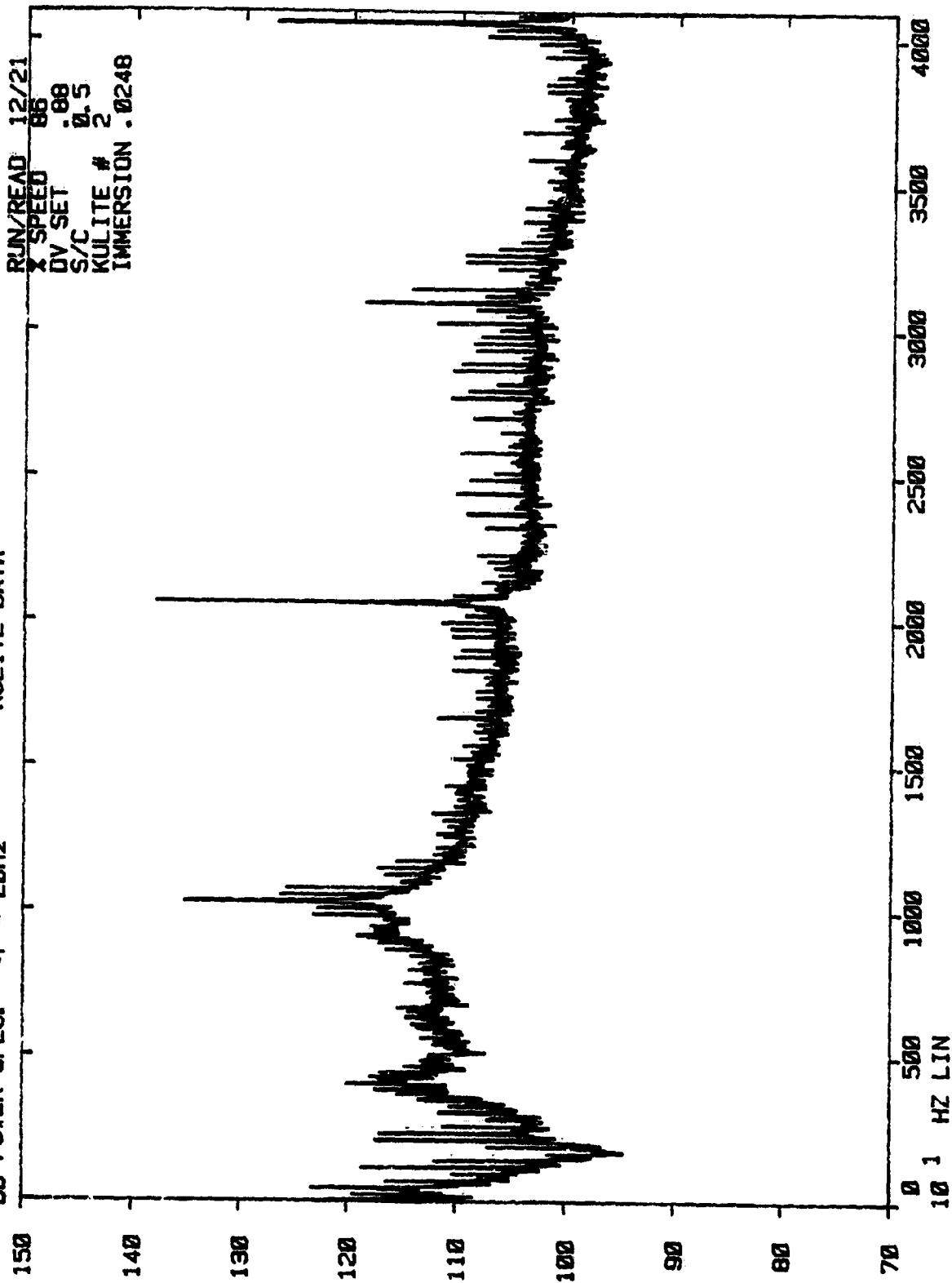
NASA V/B STUDY KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$



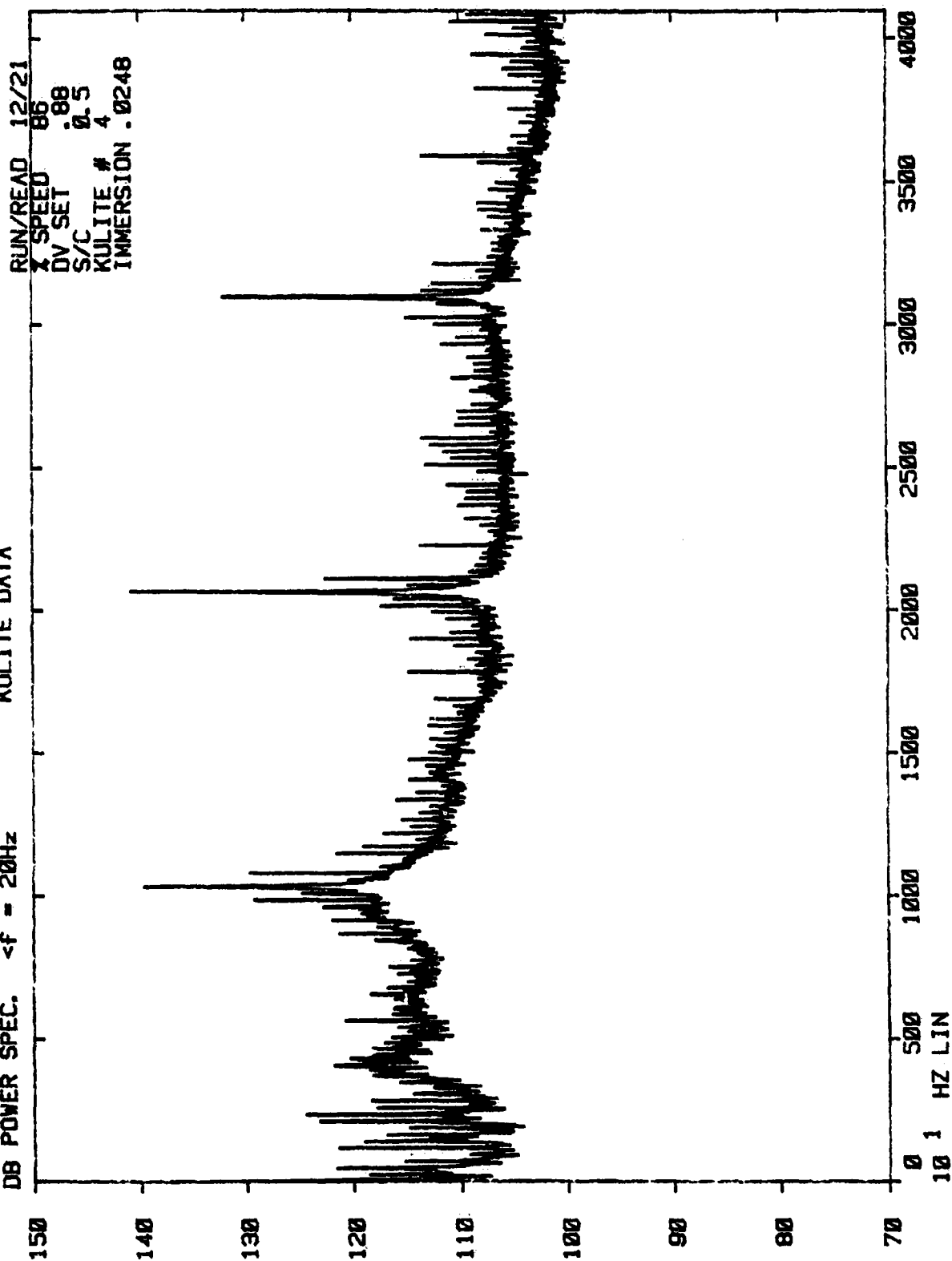
NASA V/B STUDY
KULITE DATA

DB POWER SPEC. $<f = 20\text{Hz}$



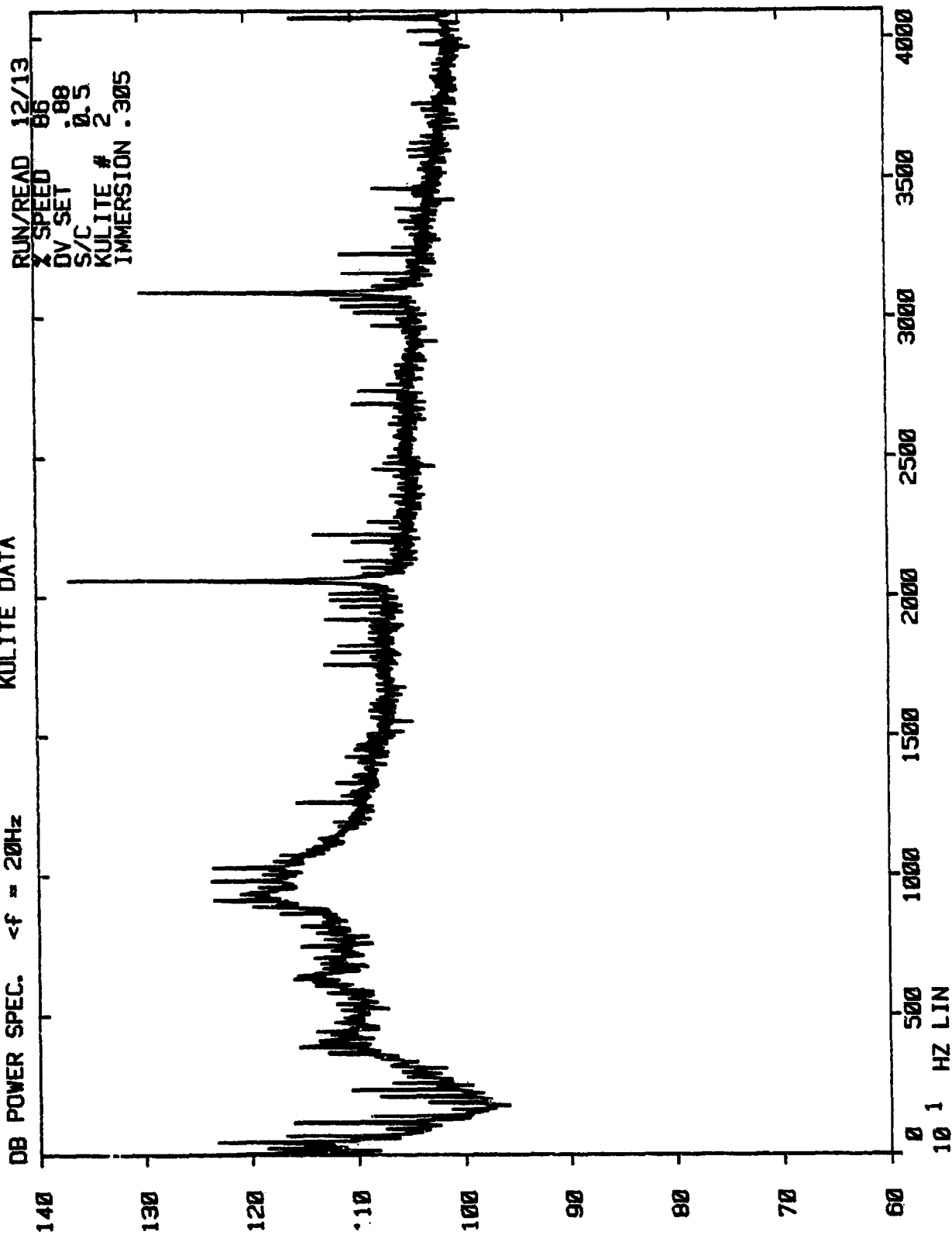
NASA V/B STUDY KULITE DATA

DB POWER SPEC. <f = 20Hz

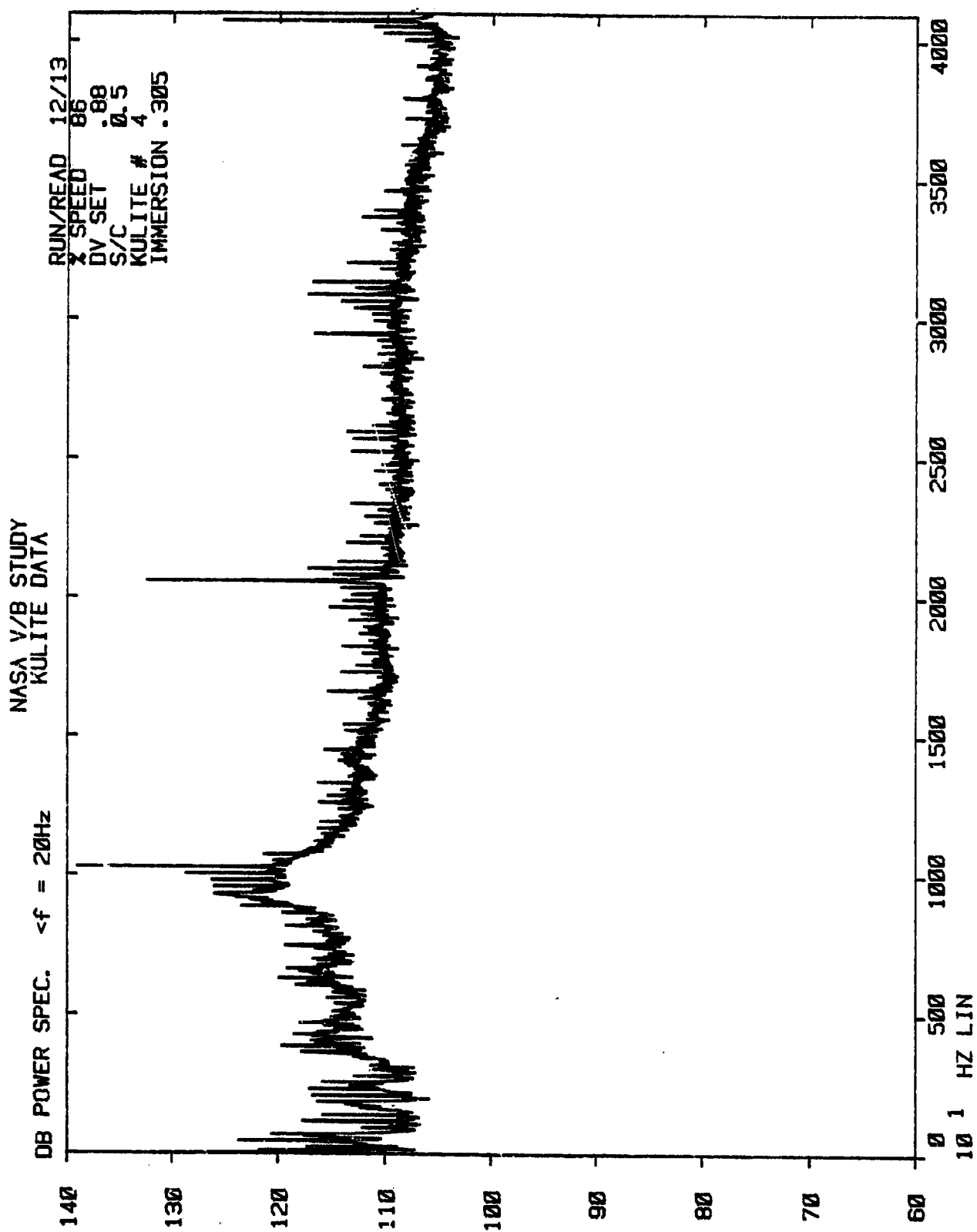


NASA V/B STUDY KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$

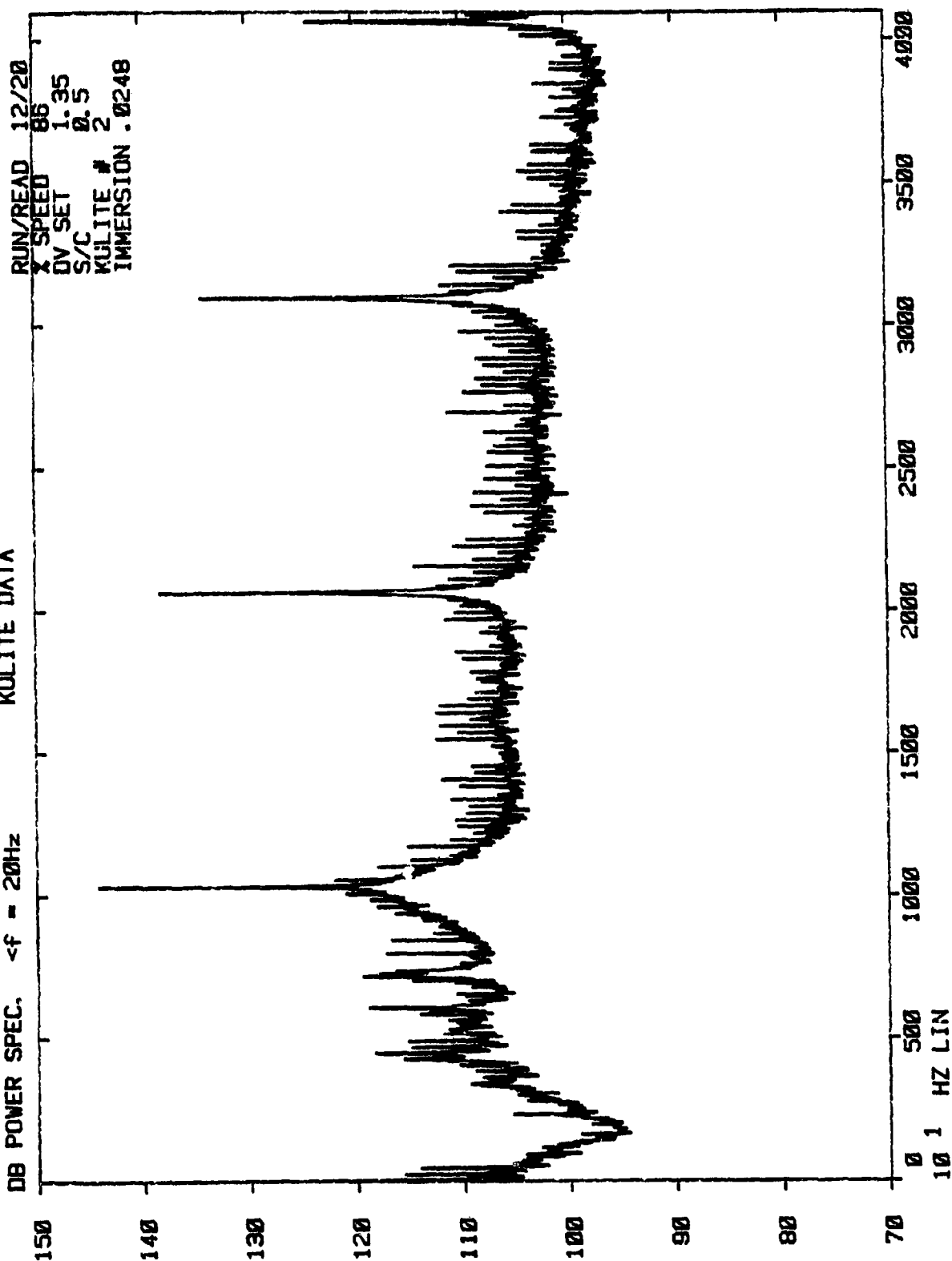


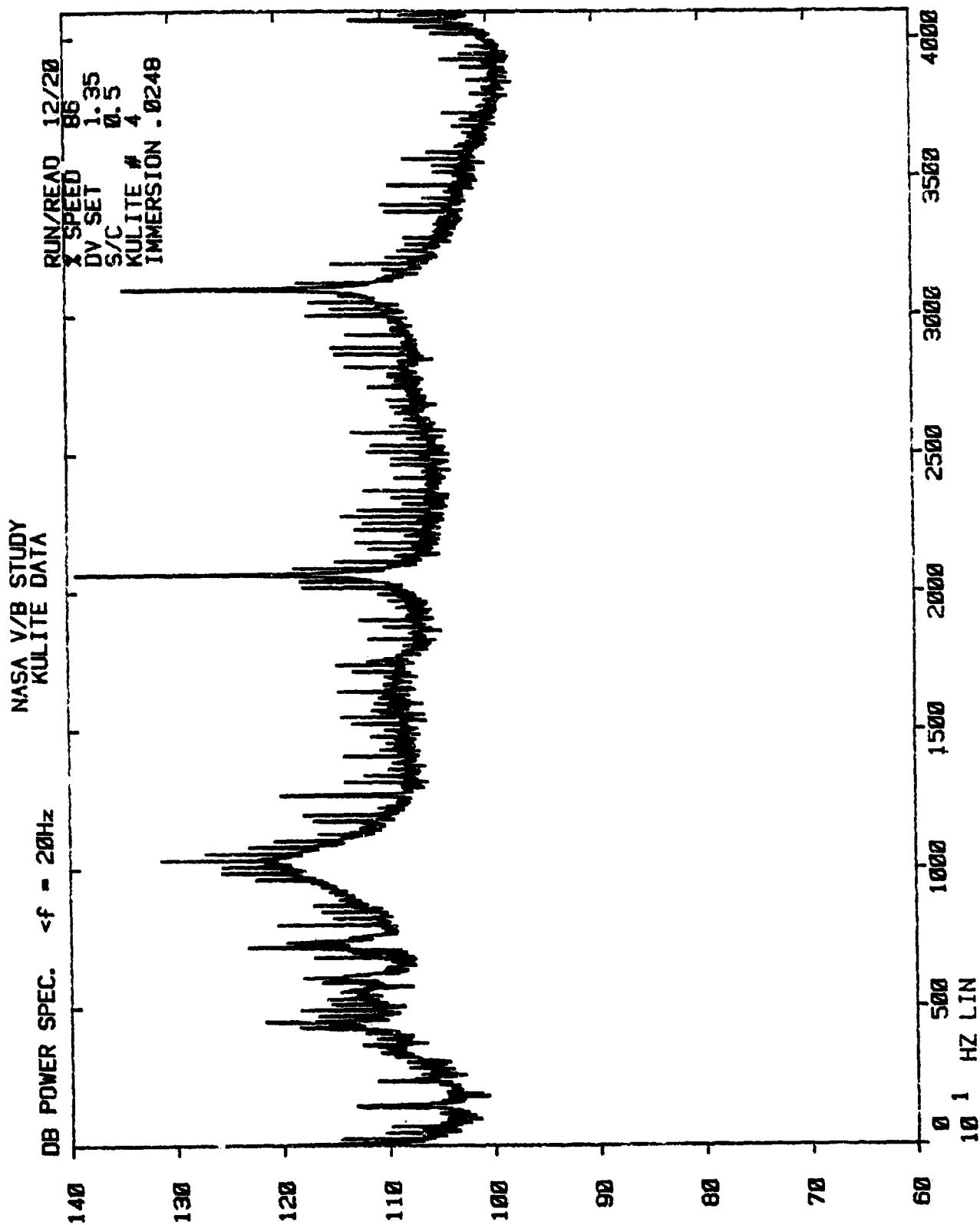
RUN/READ 12/13
Z SPEED 86
DV SET .88
S/C 0.5
KULITE # 2
IMMERSION .305



NASA V/B STUDY KULITE DATA

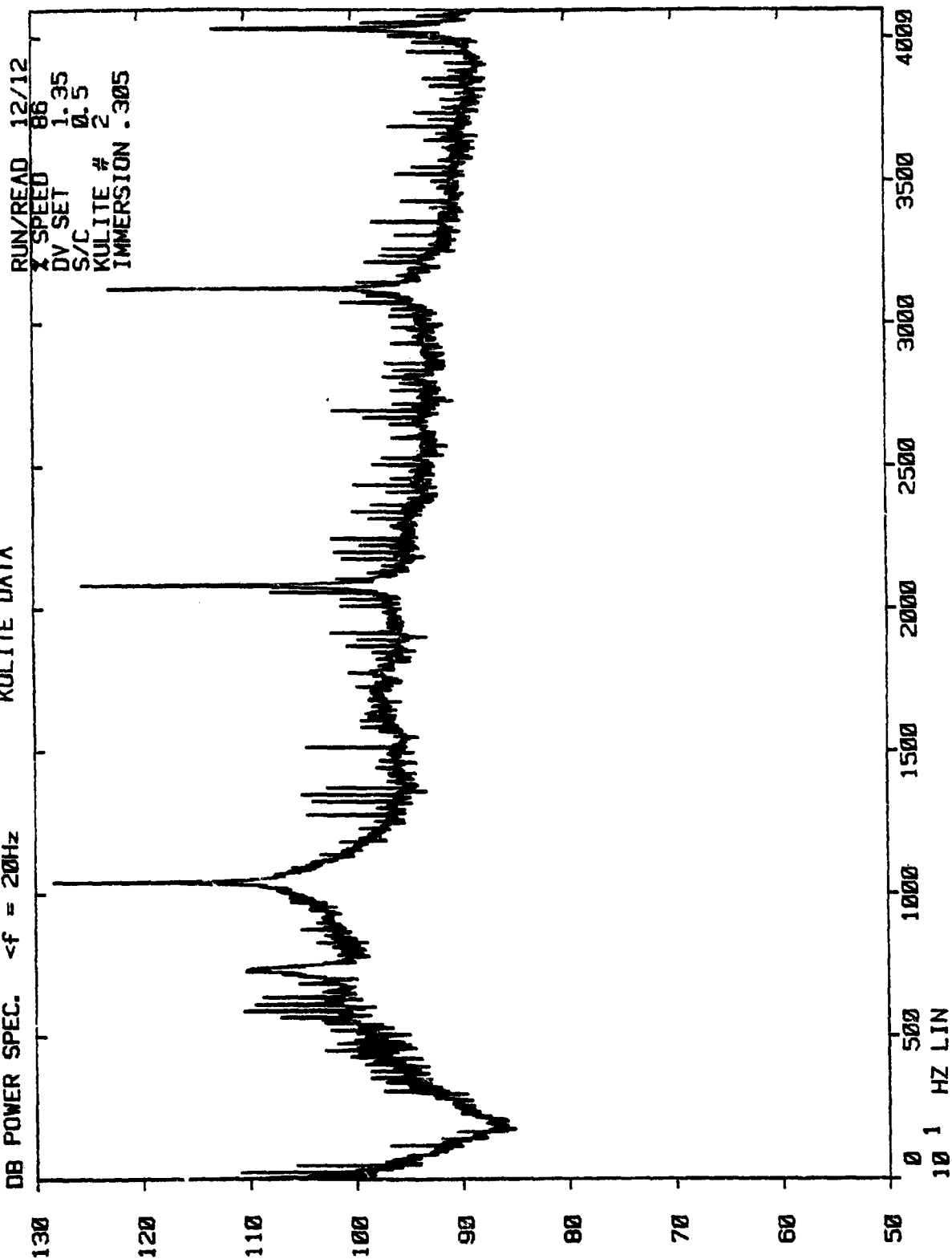
DB POWER SPEC. $\Delta f = 20\text{Hz}$

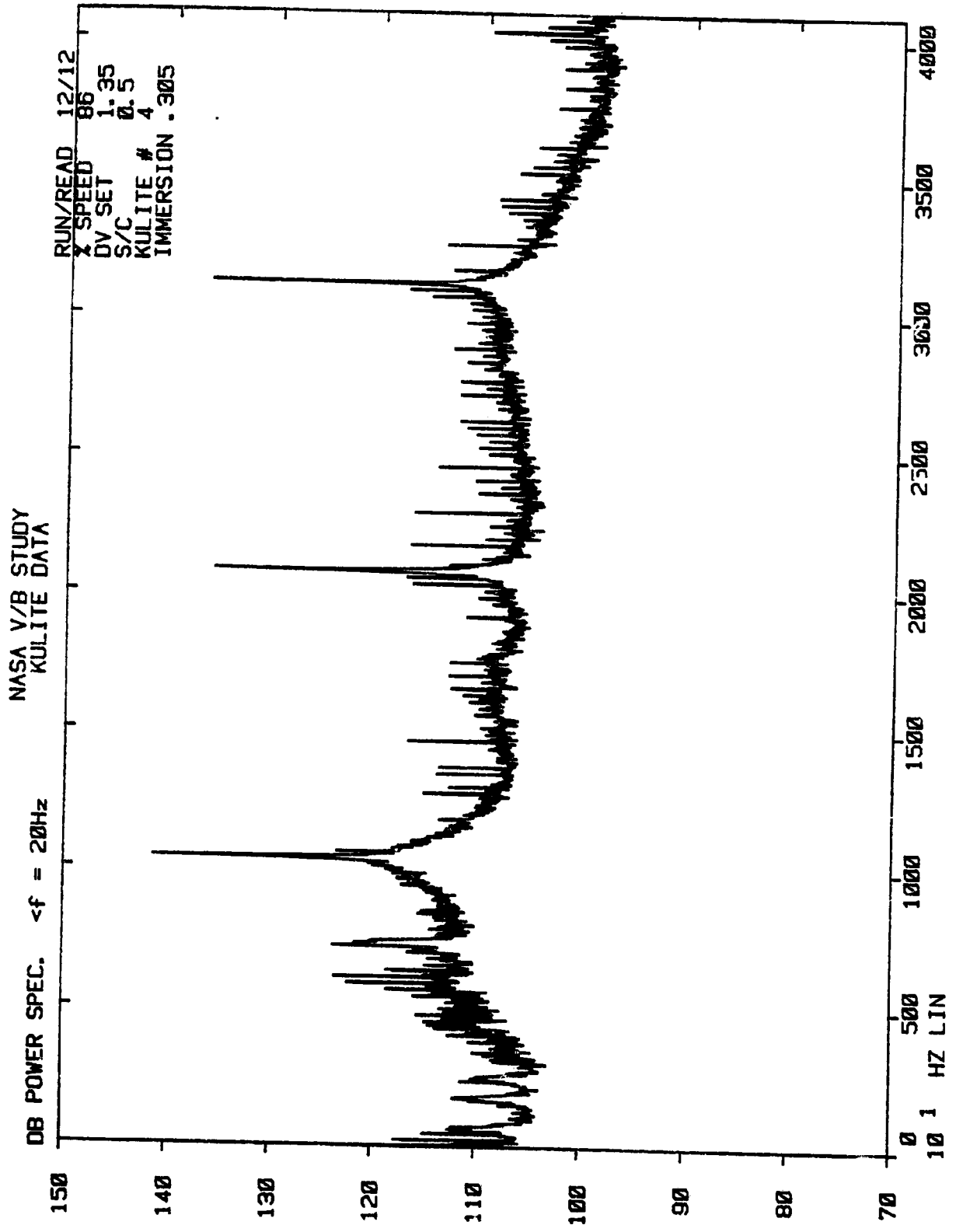




NASA V/B STUDY
KULITE DATA

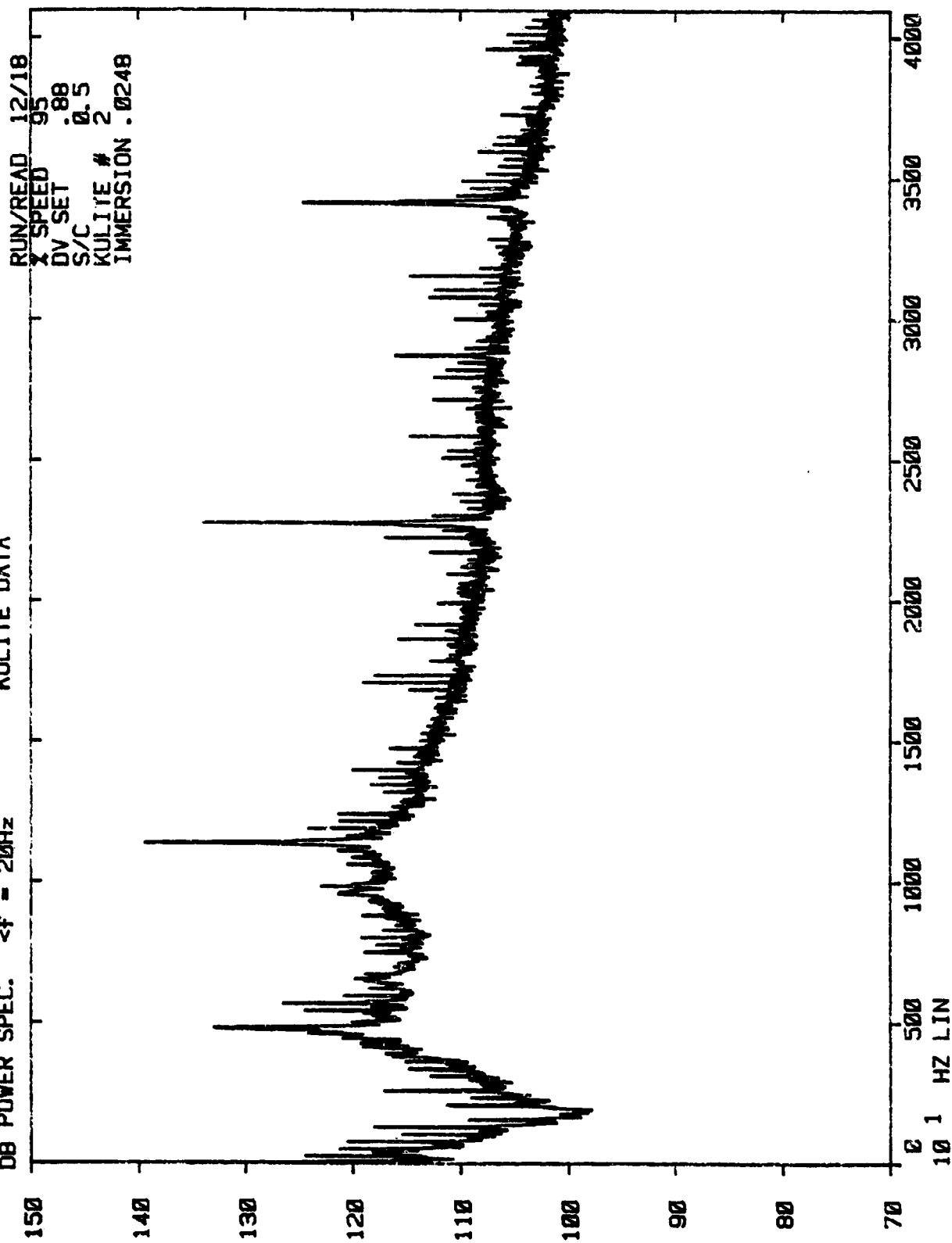
DB POWER SPEC. $<f = 20\text{Hz}$





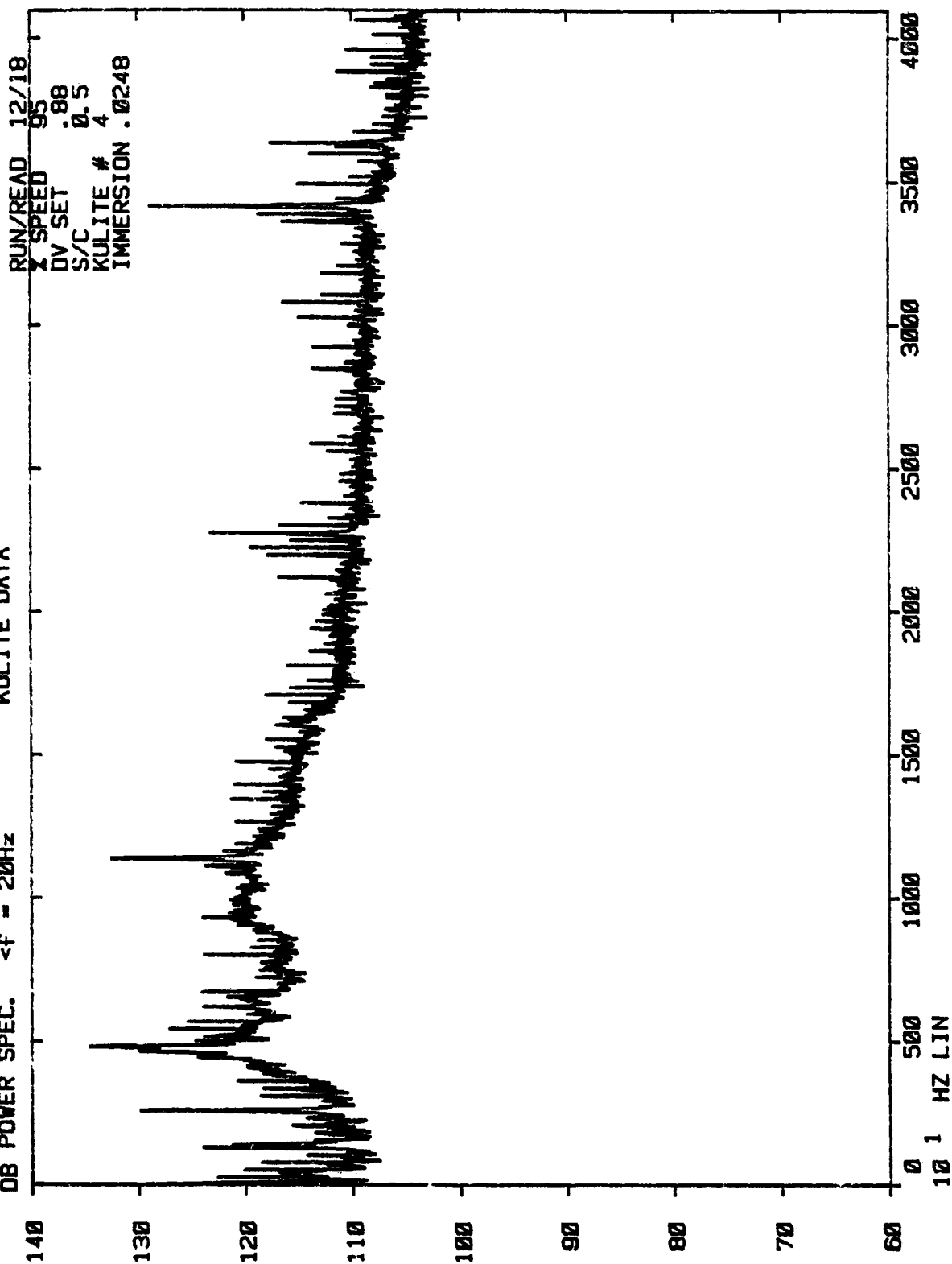
NASA V/B STUDY
KULITE DATA

DB POWER SPEC. $< f = 20\text{Hz}$



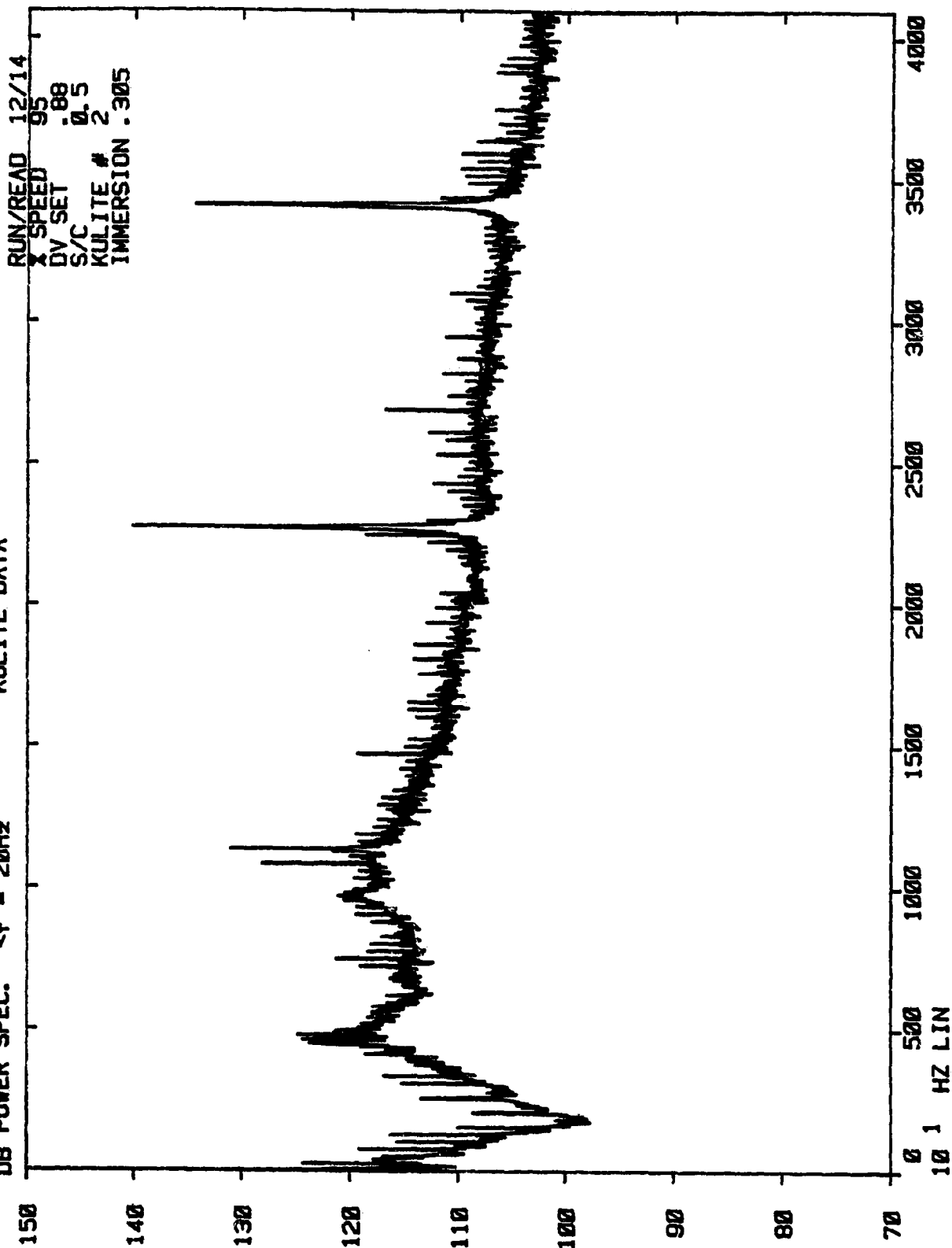
NASA V/B STUDY
KULITE DATA

DB POWER SPEC. $< f = 20\text{Hz}$



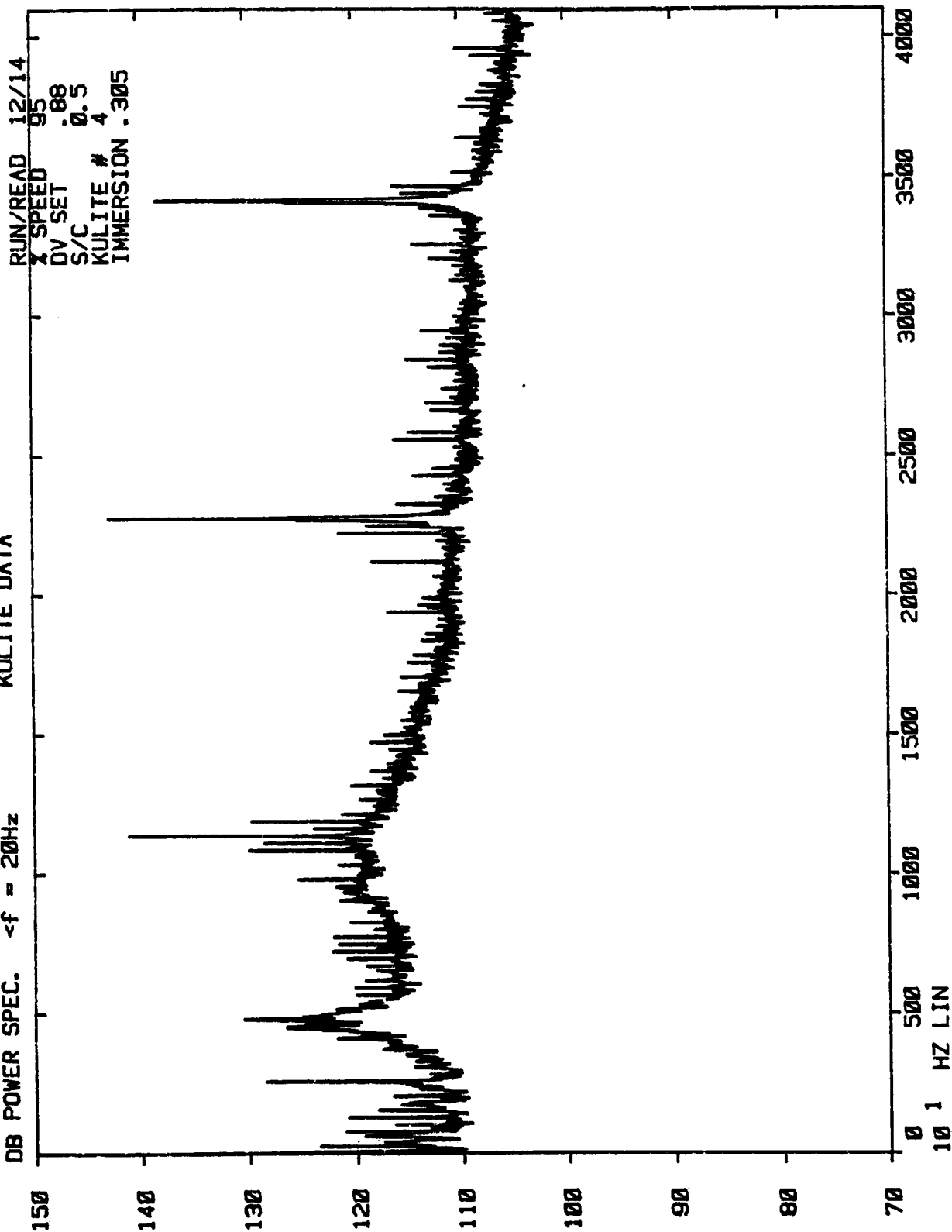
NASA V/B STUDY KULITE DATA

DB POWER SPEC. <f = 20Hz



NASA V/B STUDY
KULITE DATA

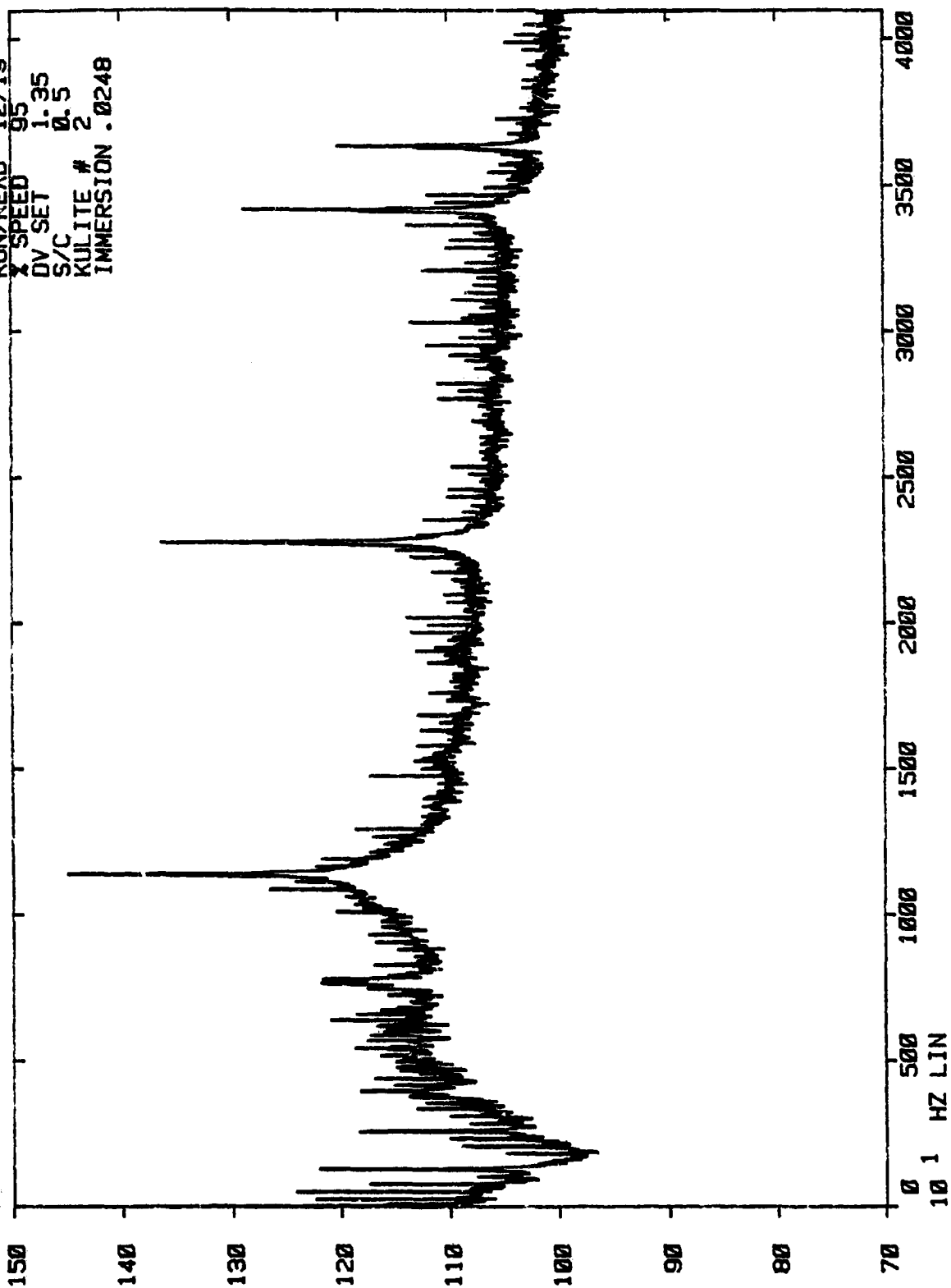
DB POWER SPEC. $\Delta f = 20\text{Hz}$



NASA V/B STUDY KULITE DATA

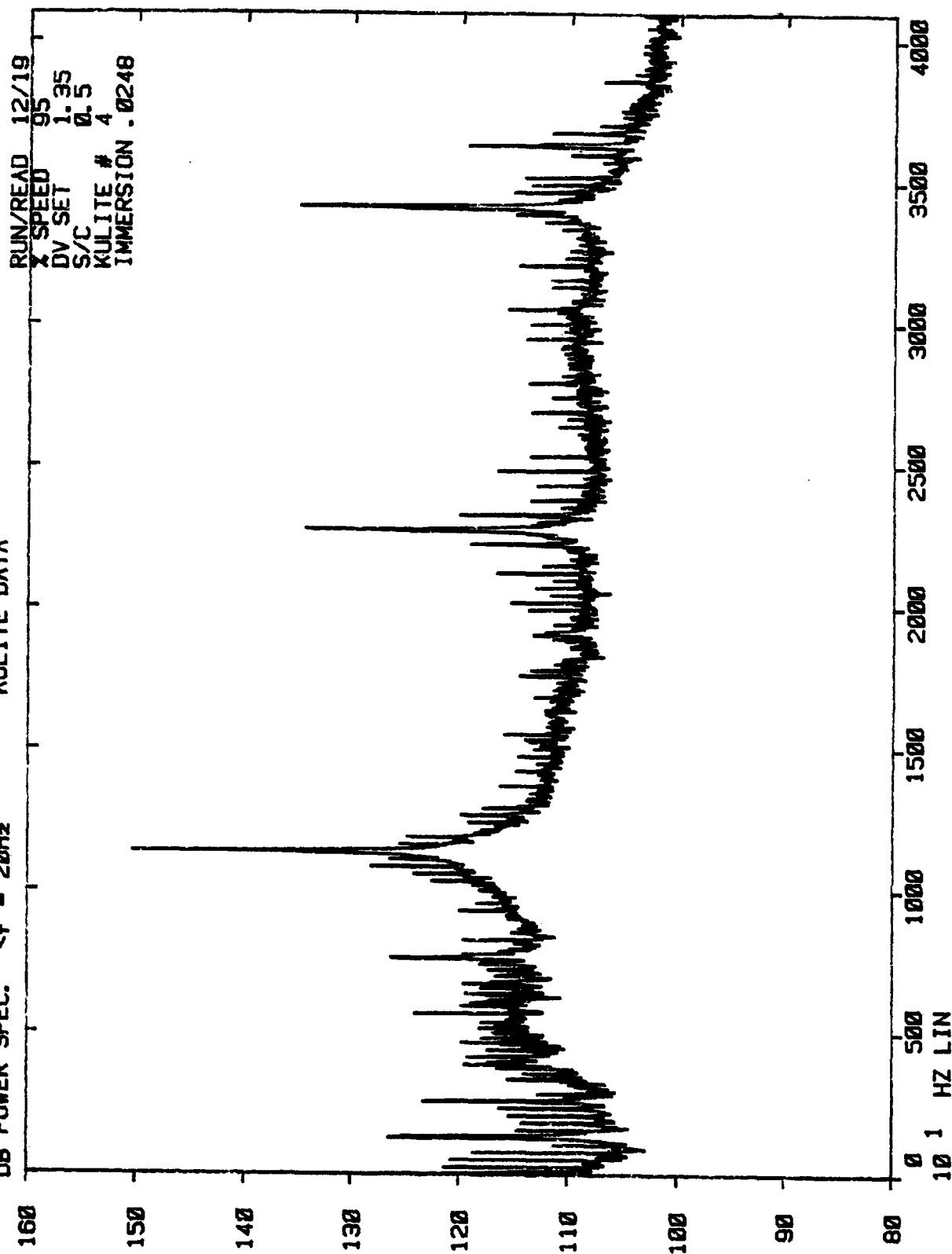
DB POWER SPEC. $\Delta f = 20\text{Hz}$

RUN/READ 12/19
X SPEED 95
DV SET 1.35
S/C 0.5
KULITE # 2
IMMERSION .0248



NASA V/B STUDY KULITE DATA

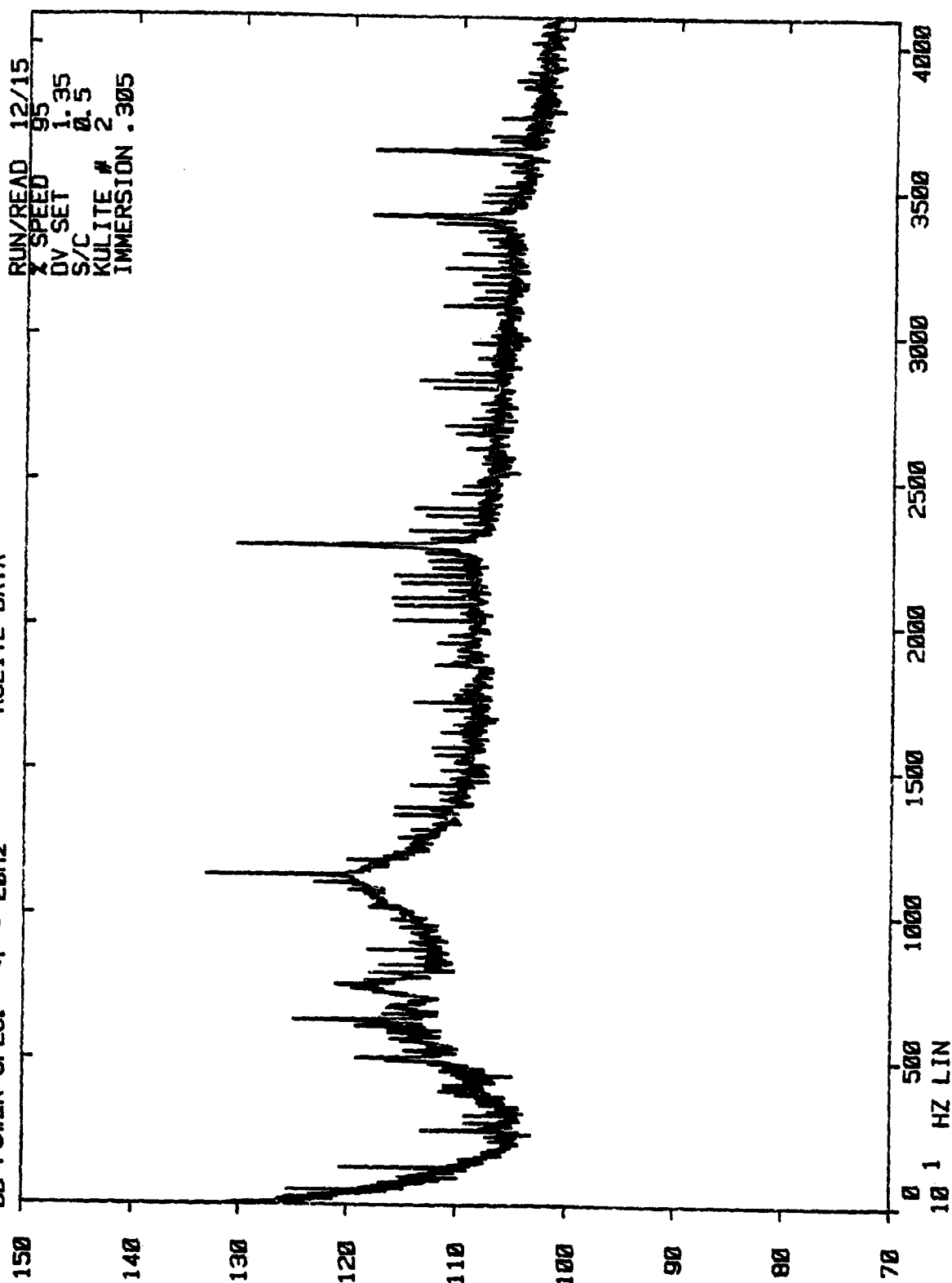
DB POWER SPEC. $<f = 20\text{Hz}$



RUN/READ 12/19
X SPEED 95
DV SET 1.35
S/C 0.5
KULITE # 4
IMMERSION .0248

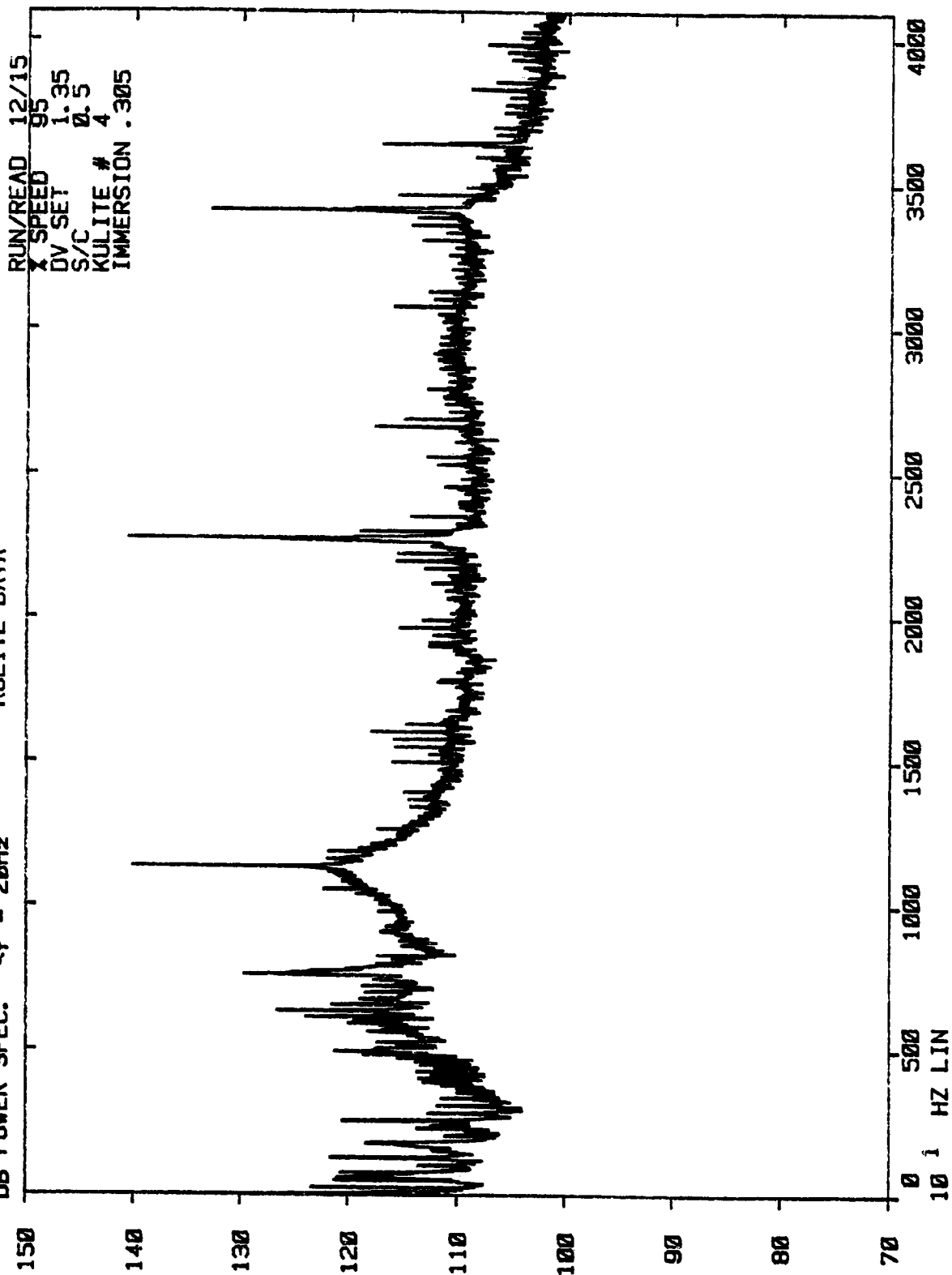
NASA V/B STUDY KULITE DATA

DB POWER SPEC. $<f = 20\text{Hz}$



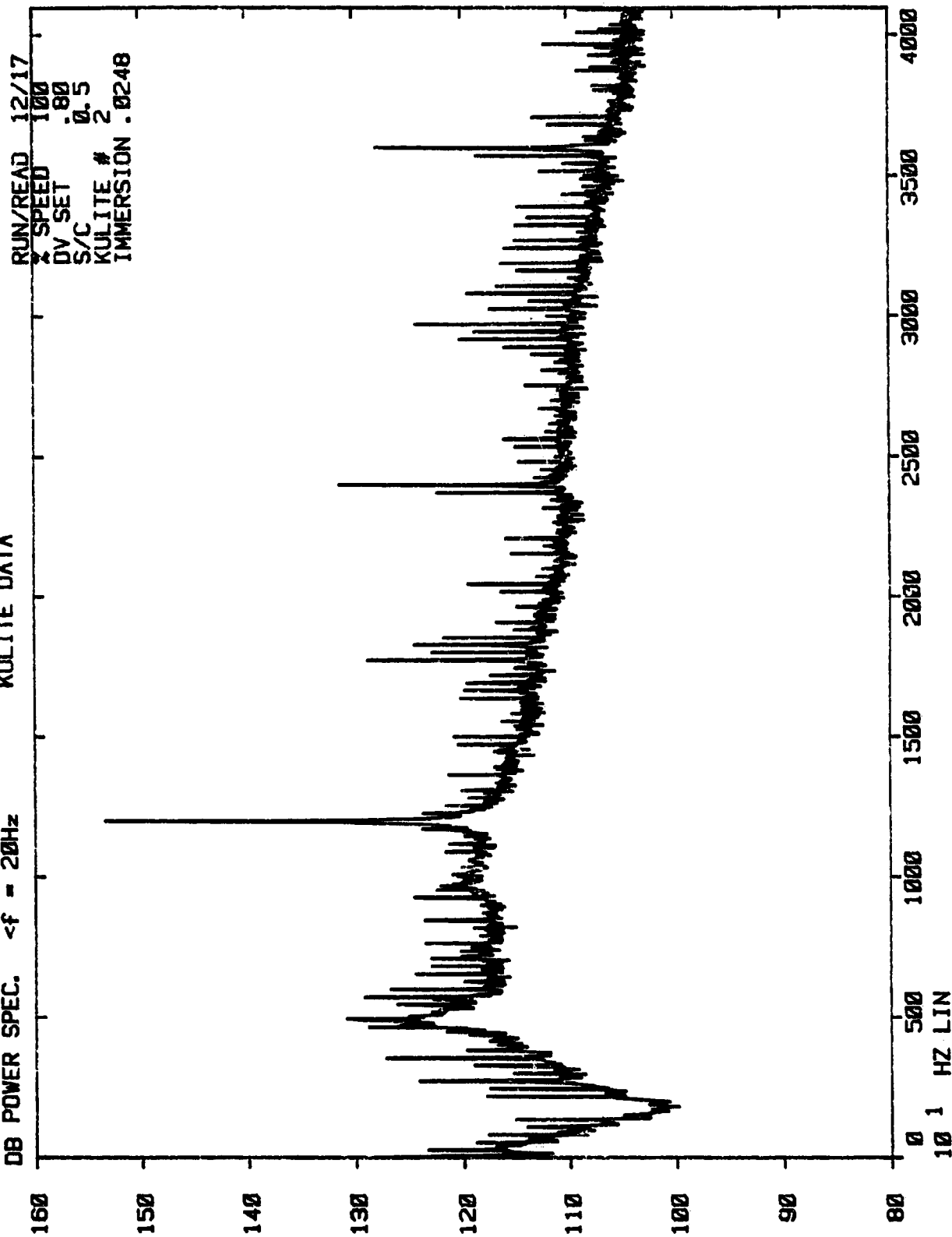
NASA V/B STUDY
KULITE DATA

DB POWER SPEC. $\angle f = 20\text{Hz}$



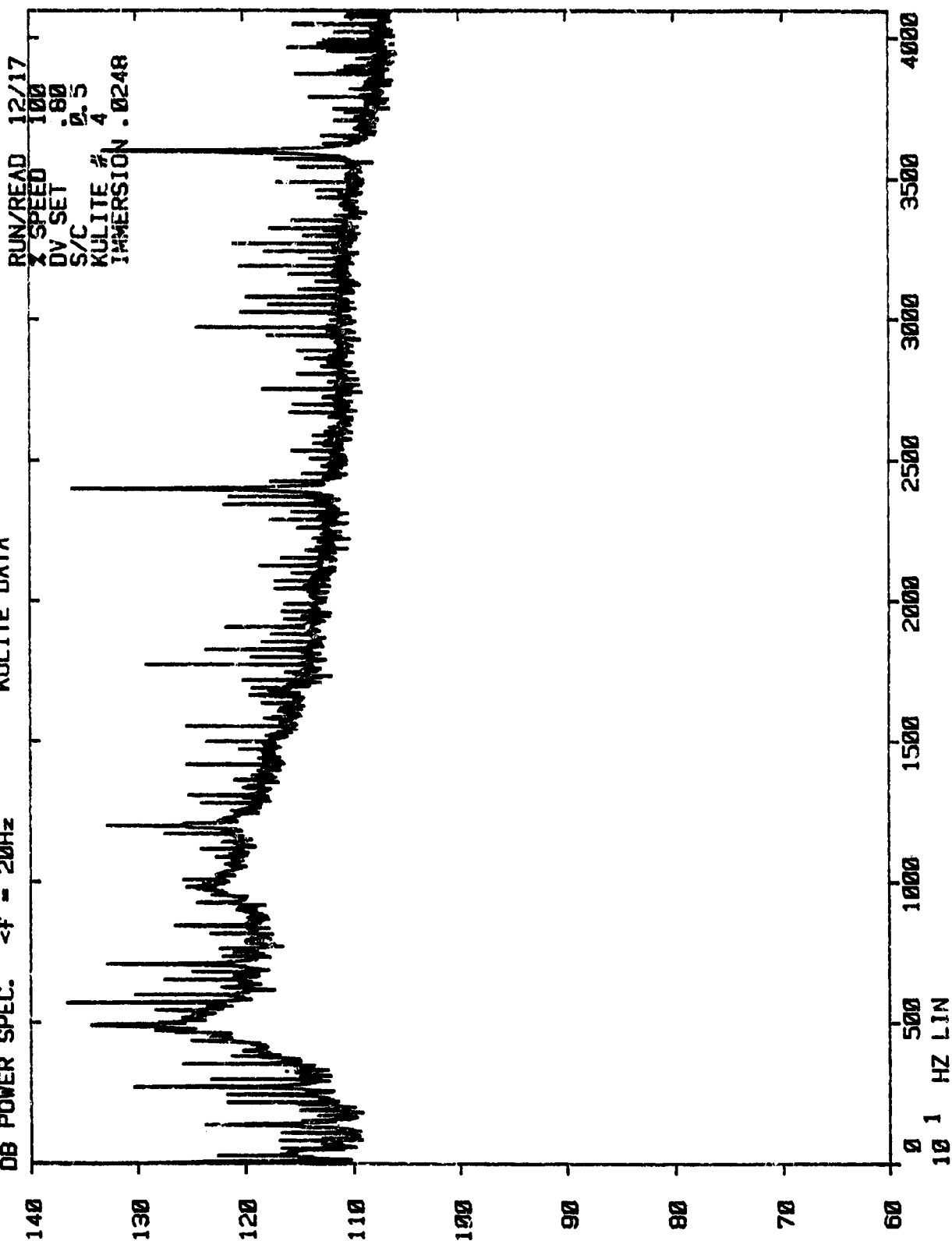
NASA V/B STUDY KULITE DATA

DB POWER SPEC. $<f = 20\text{Hz}$



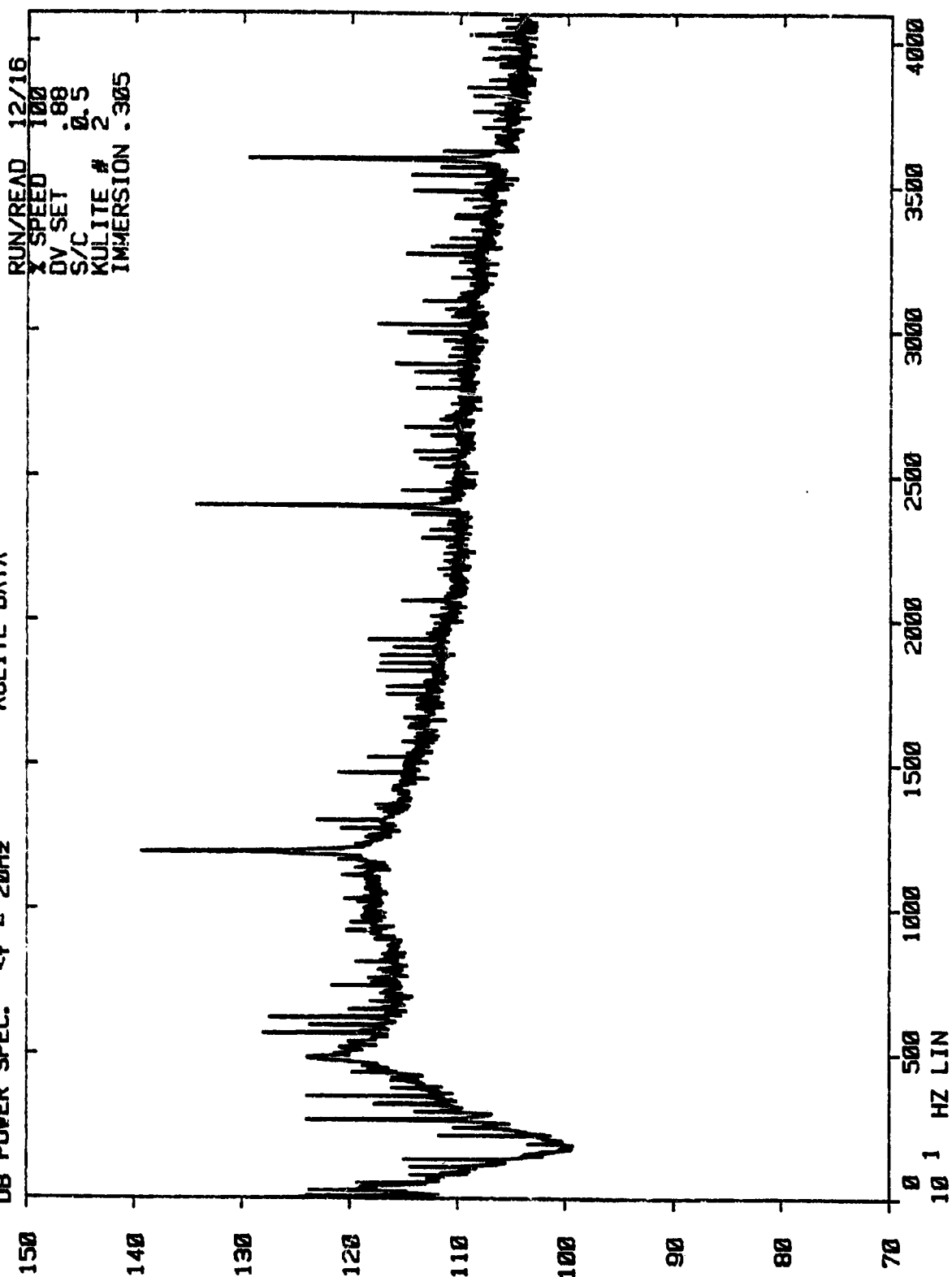
NASA V/B STUDY
KULITE DATA

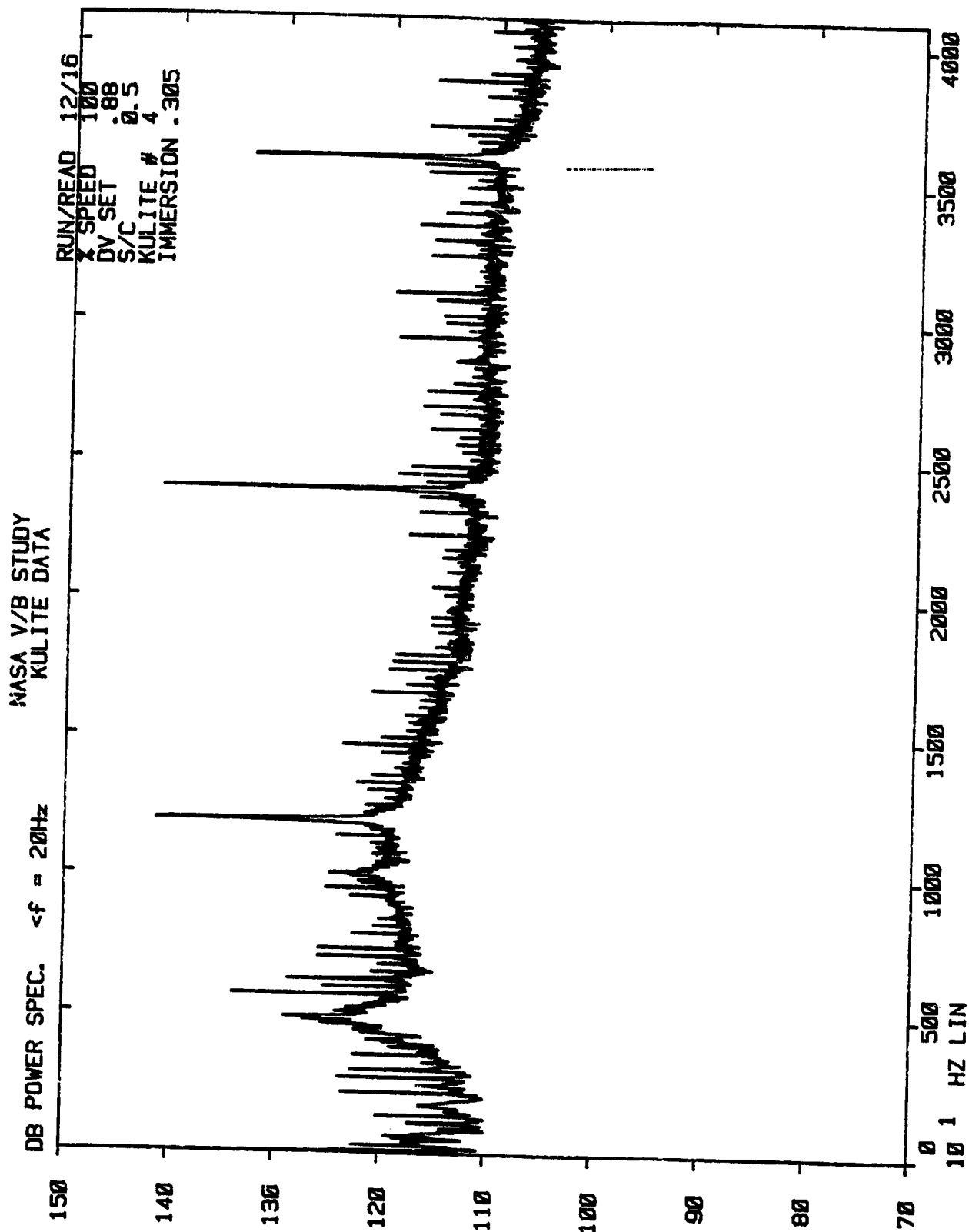
DB POWER SPEC. $< f = 20\text{Hz}$



NASA V/B STUDY
KULITE DATA

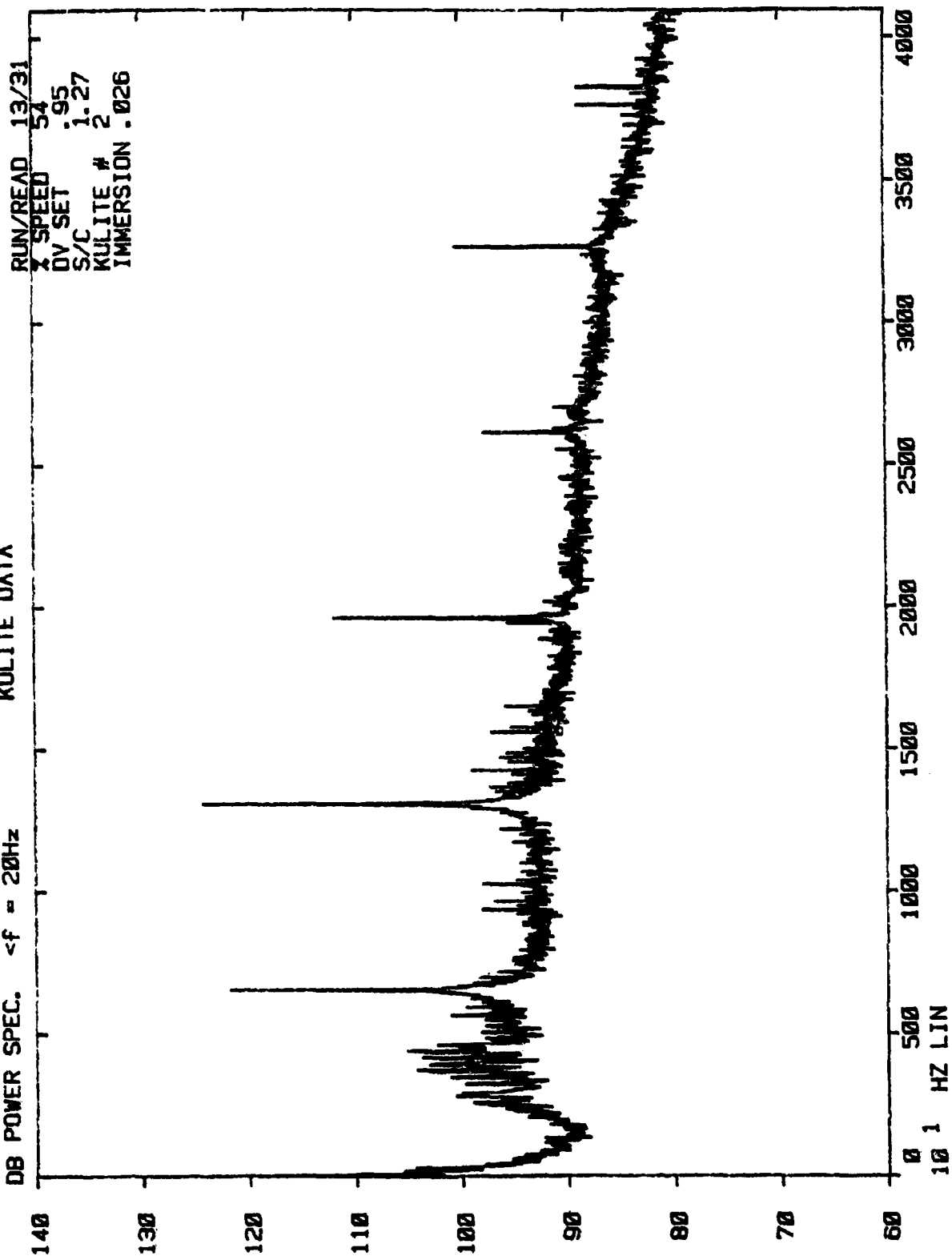
DB POWER SPEC. $<f = 20\text{Hz}$





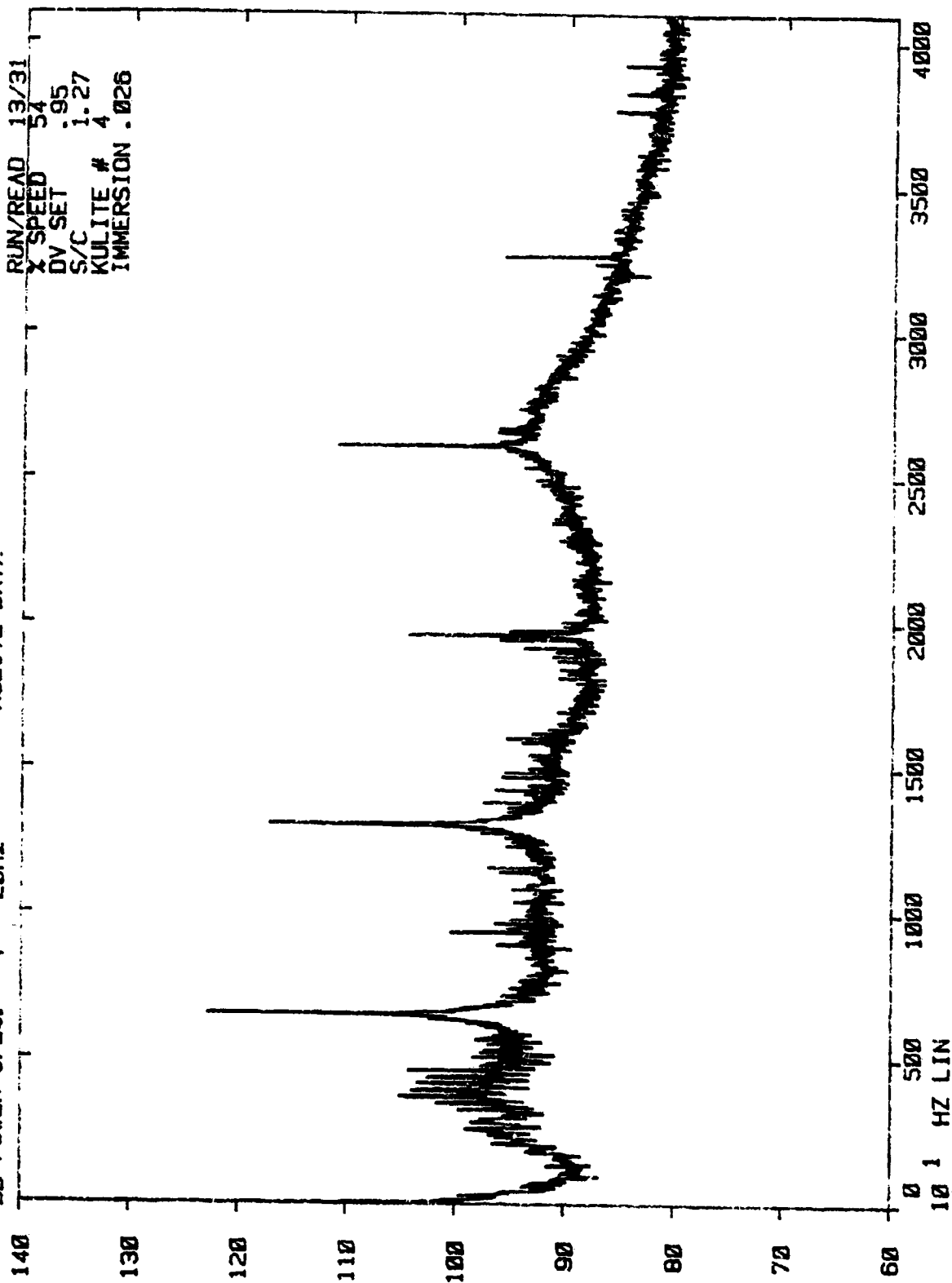
NASA V/B STUDY KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$



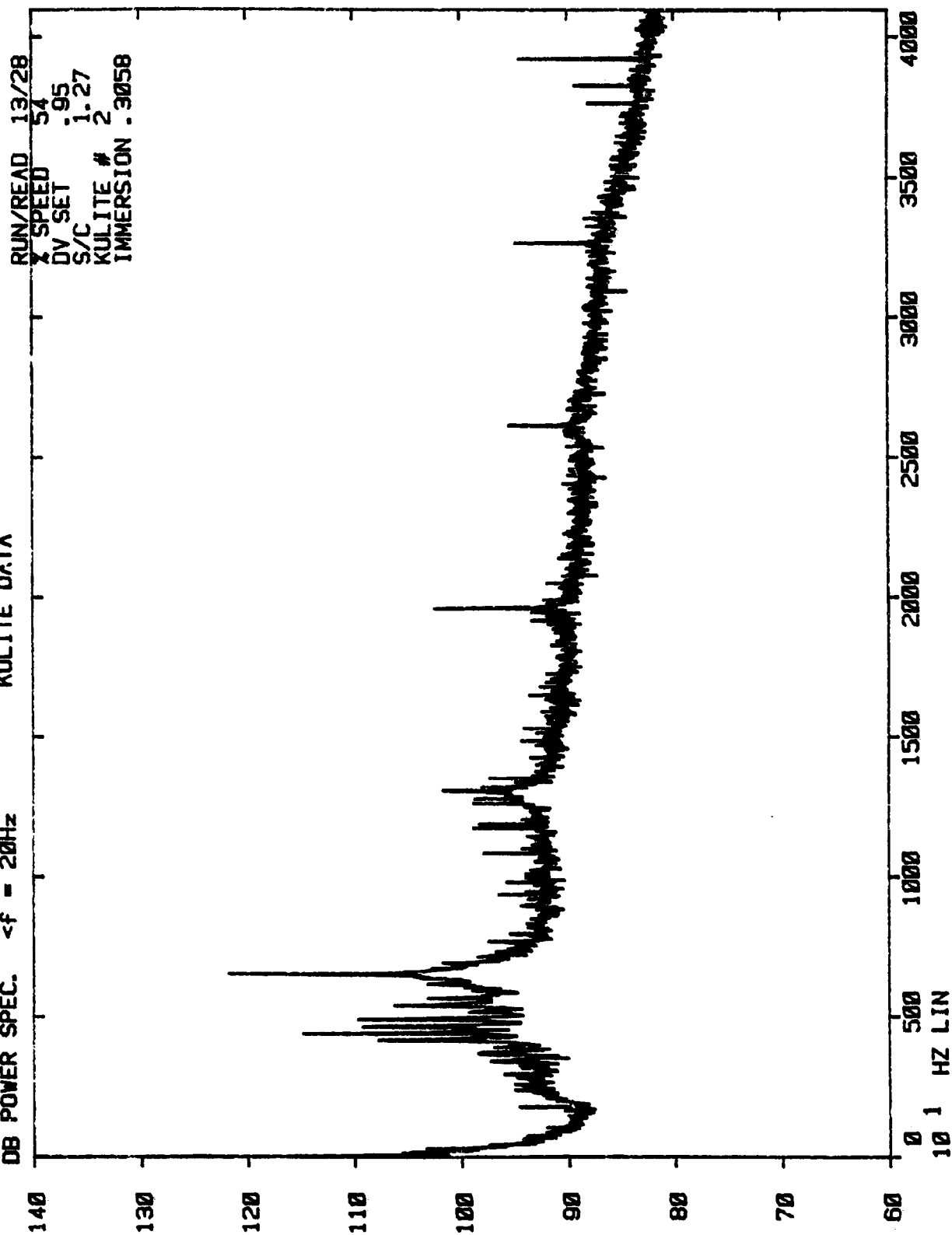
NASA V/B STUDY KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$



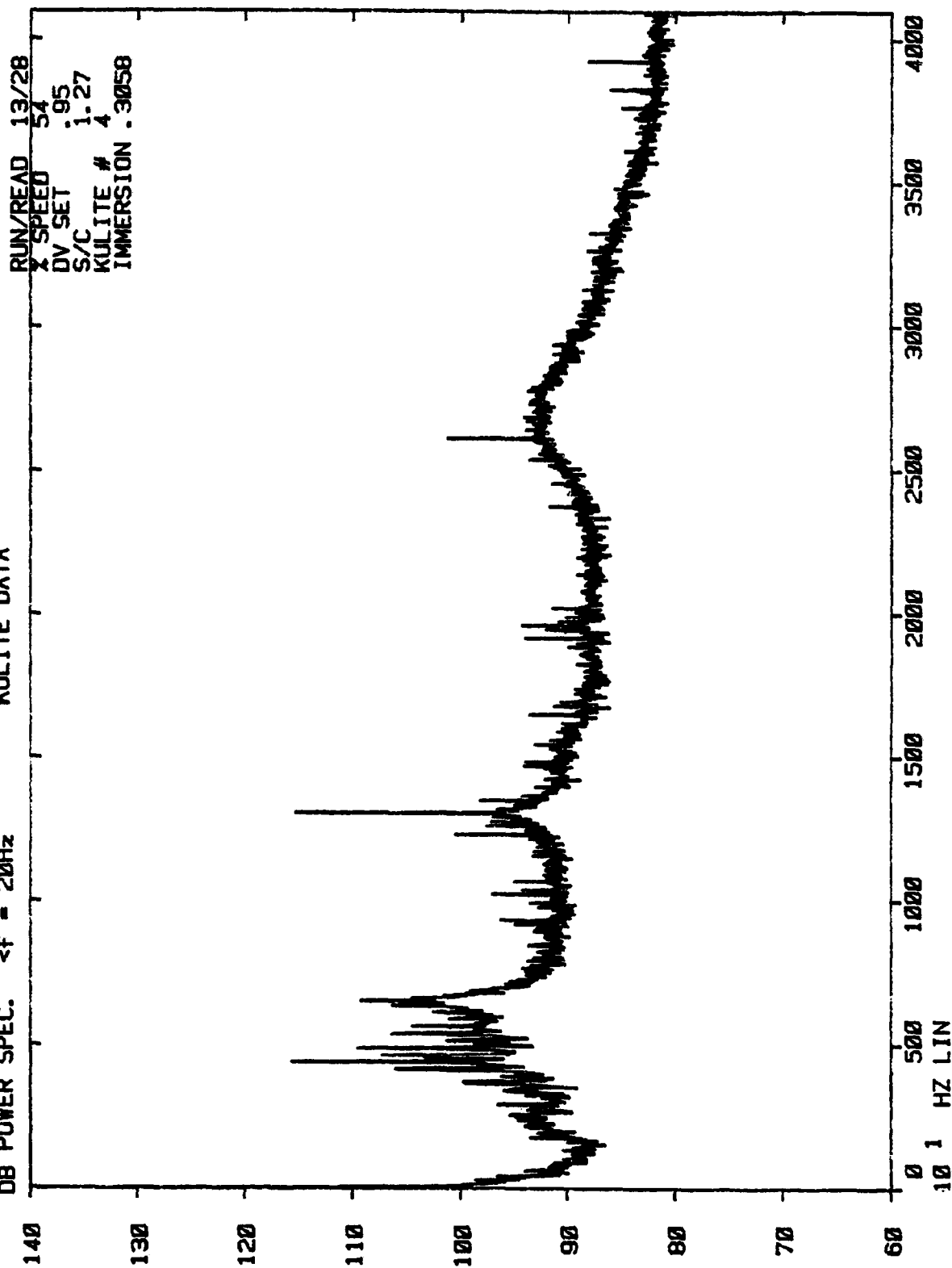
NASA V/B STUDY
KULITE DATA

DB POWER SPEC. $<f = 20\text{Hz}$



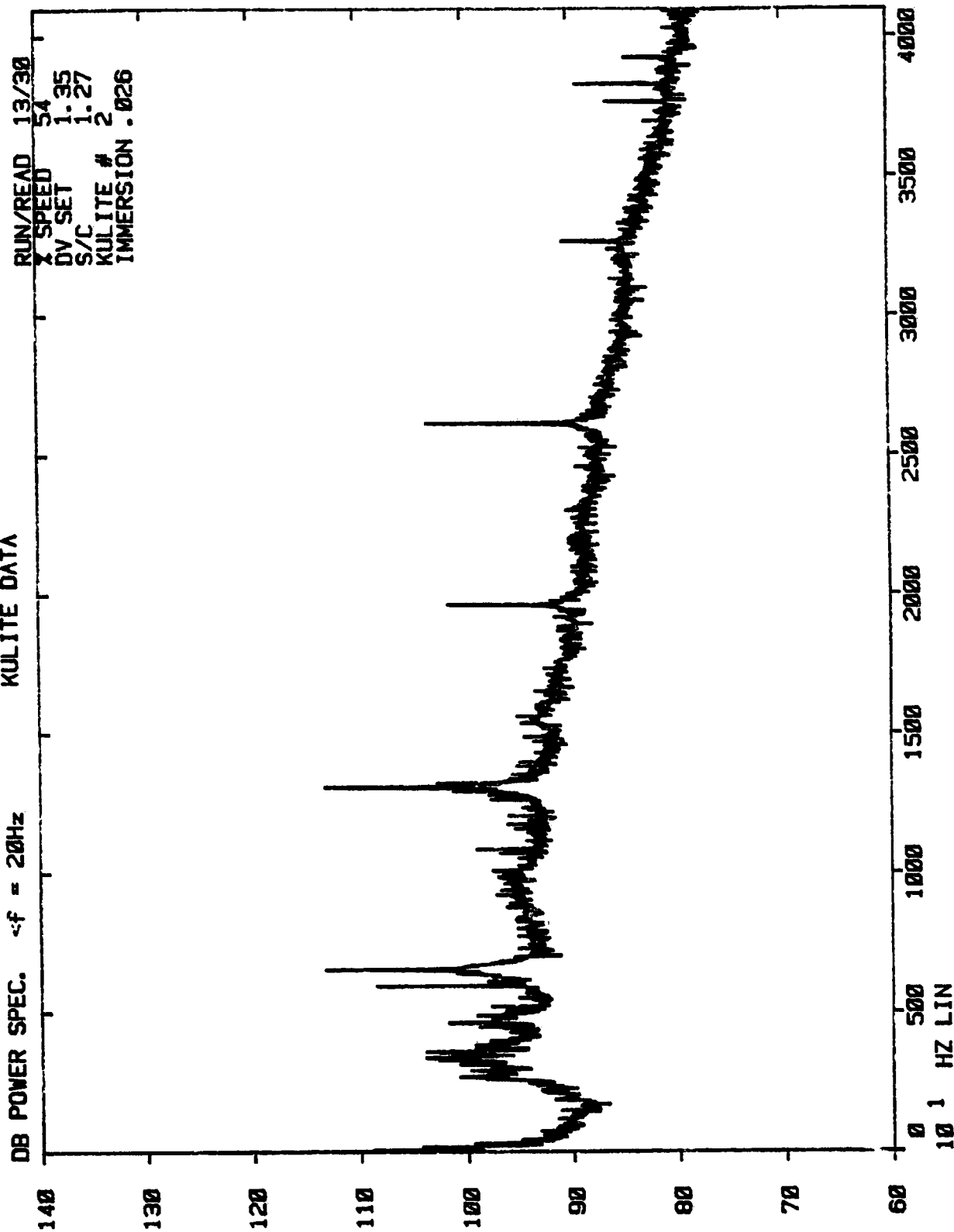
NASA V/B STUDY
KULITE DATA

DB POWER SPEC. $< f = 20\text{Hz}$



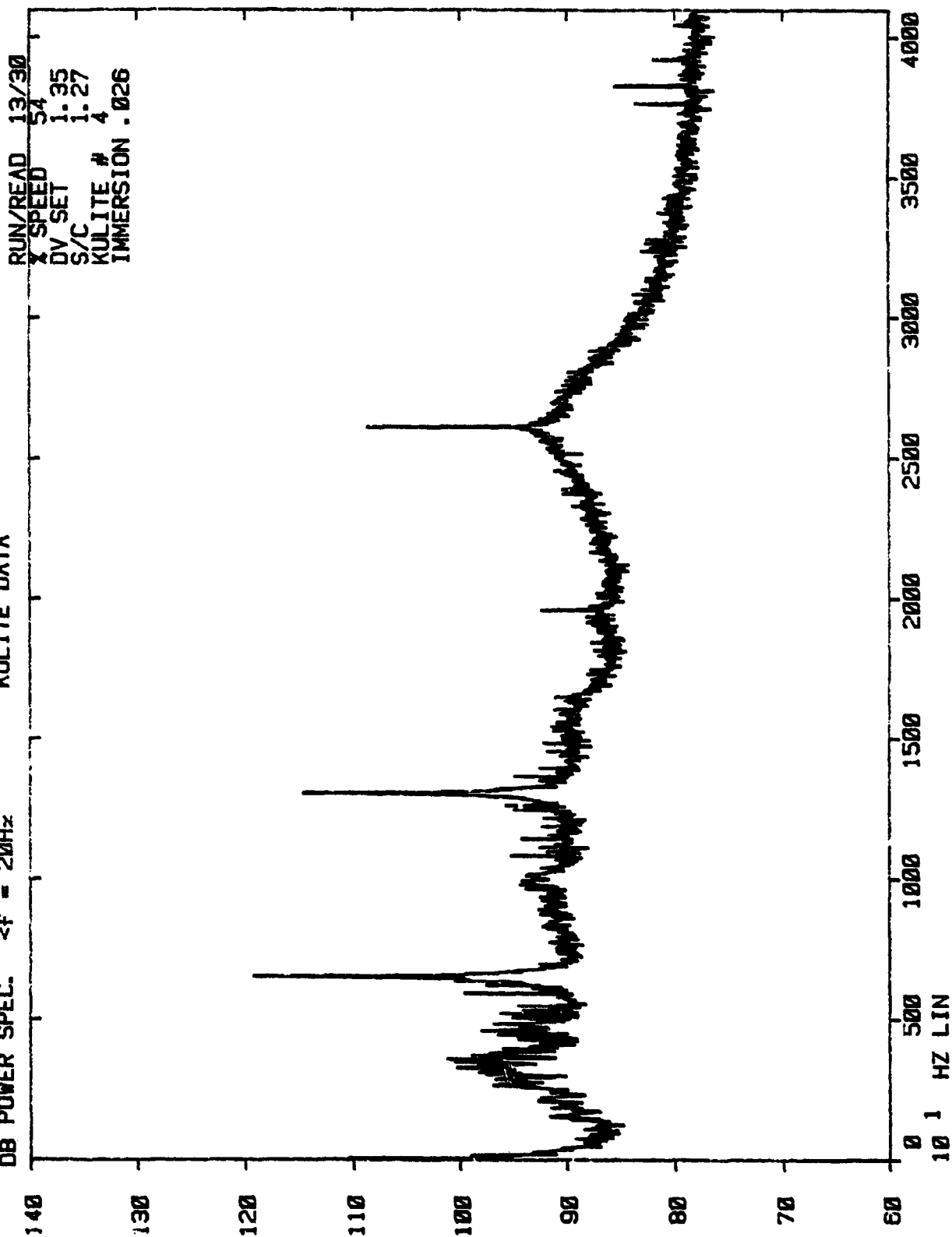
NASA V/B STUDY KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$



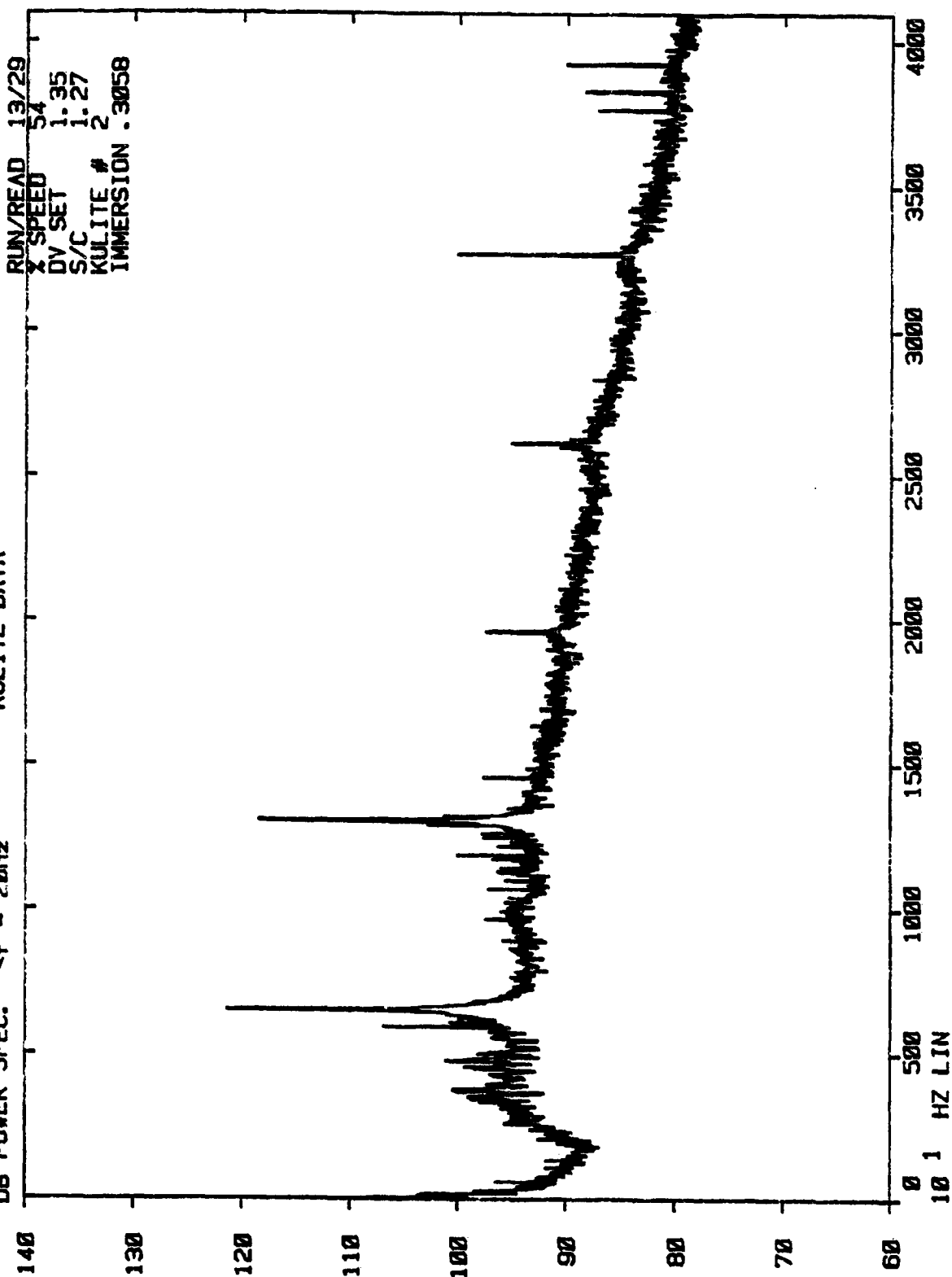
NASA V/B STUDY
KULITE DATA

DB POWER SPEC. $<f = 20\text{Hz}$

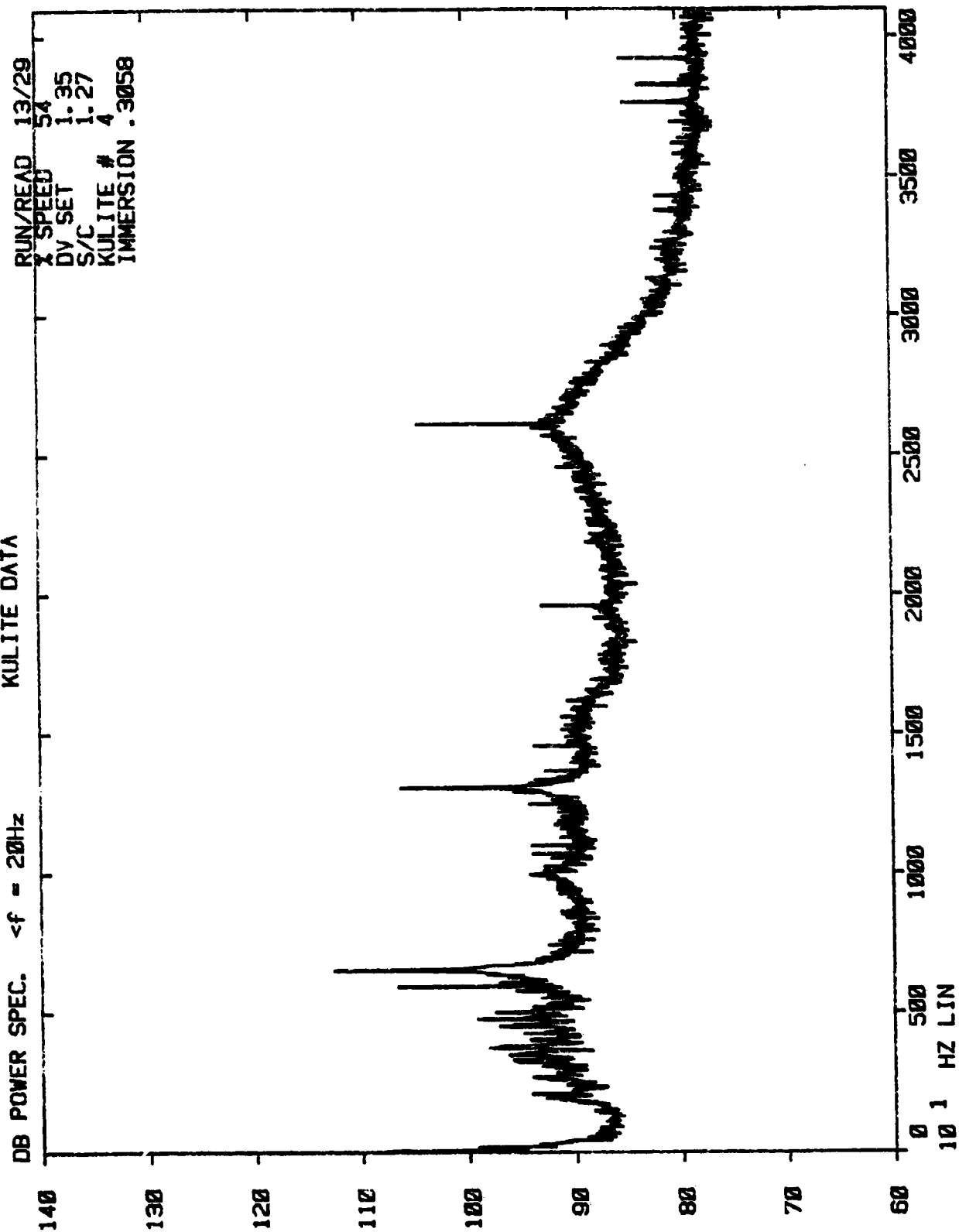


NASA V/B STUDY KULITE DATA

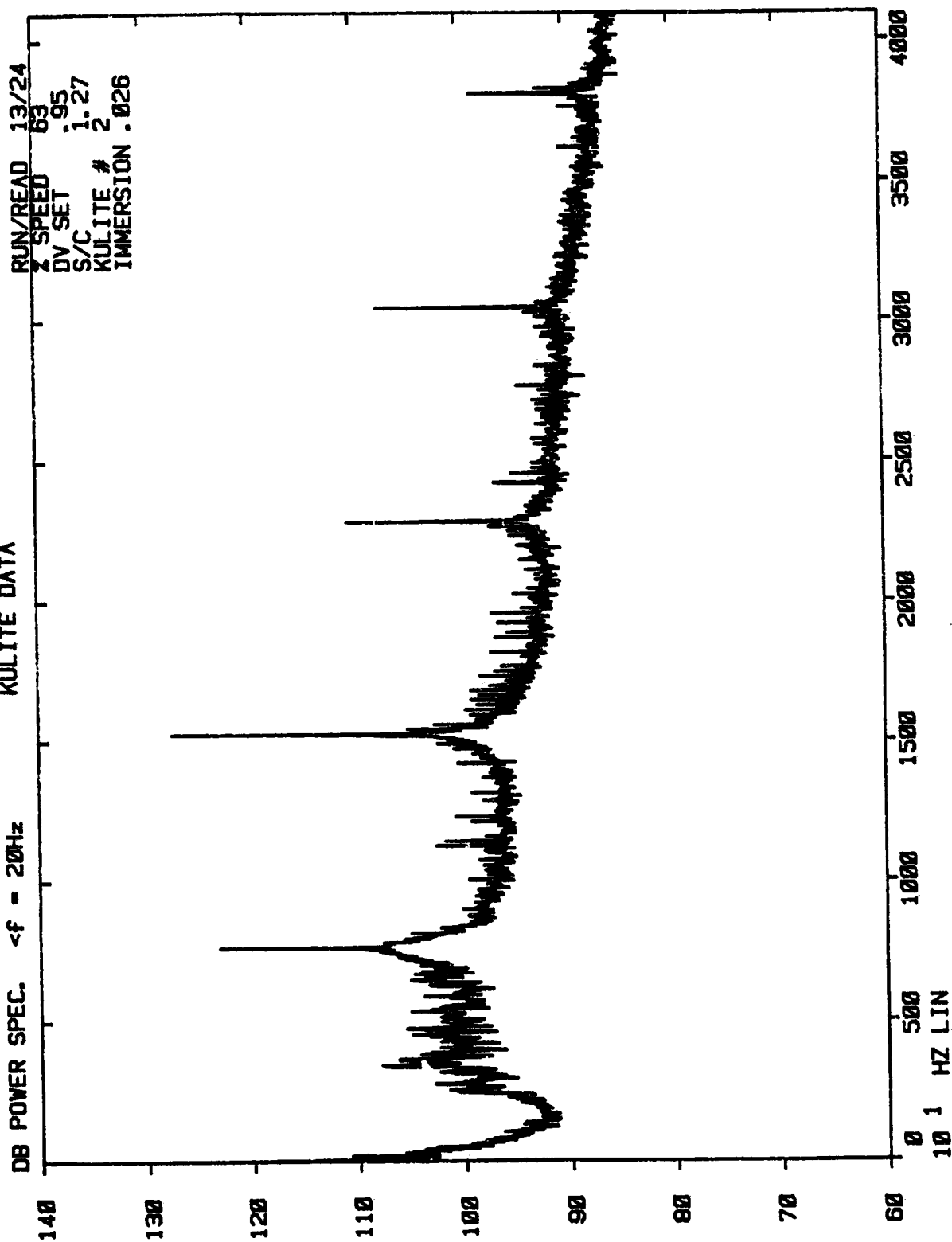
DB POWER SPEC. $<f = 20\text{Hz}$



NASA V/B STUDY
KULITE DATA

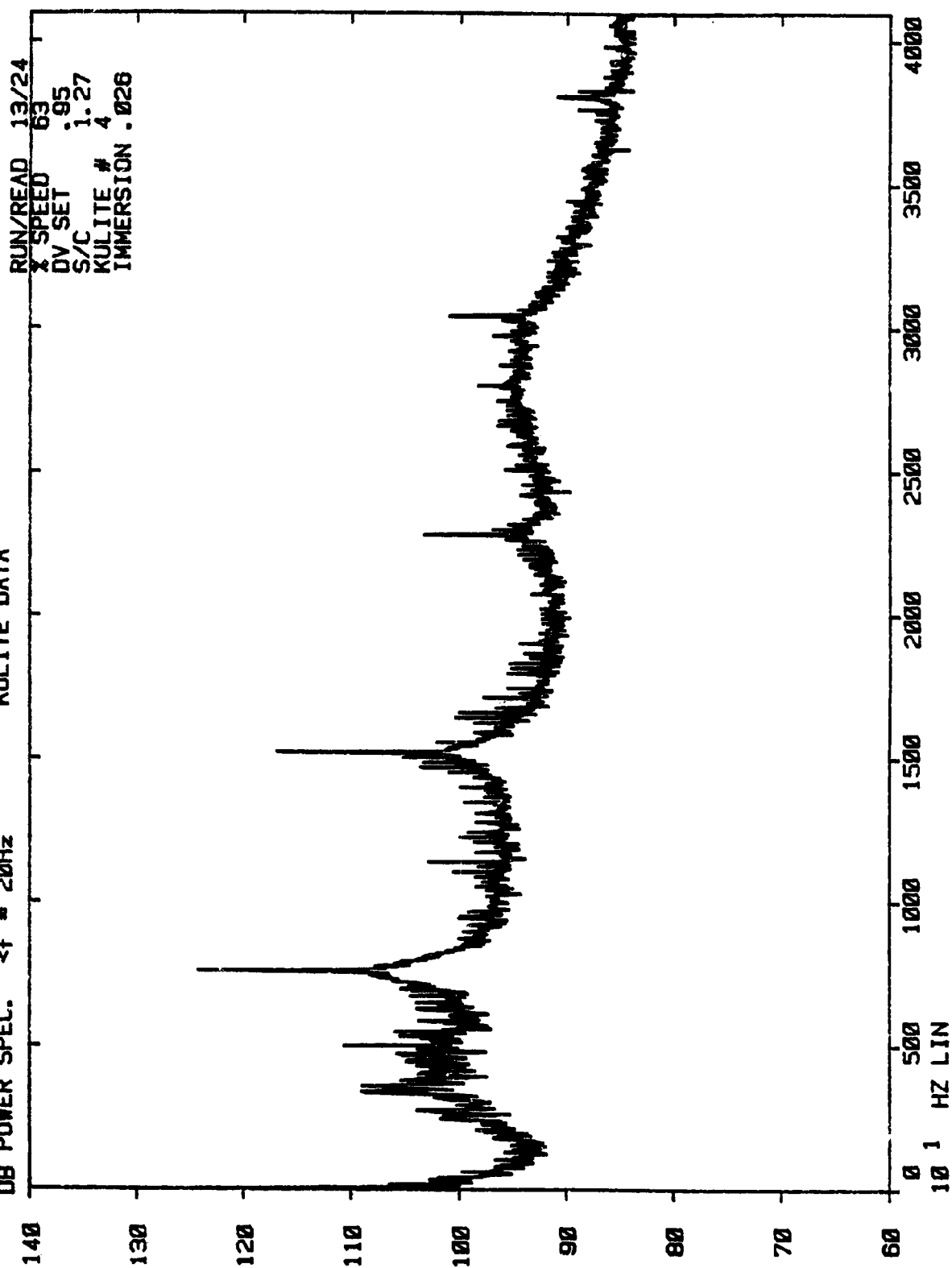


NASA V/B STUDY
KULITE DATA



NASA V/B STUDY
KULITE DATA

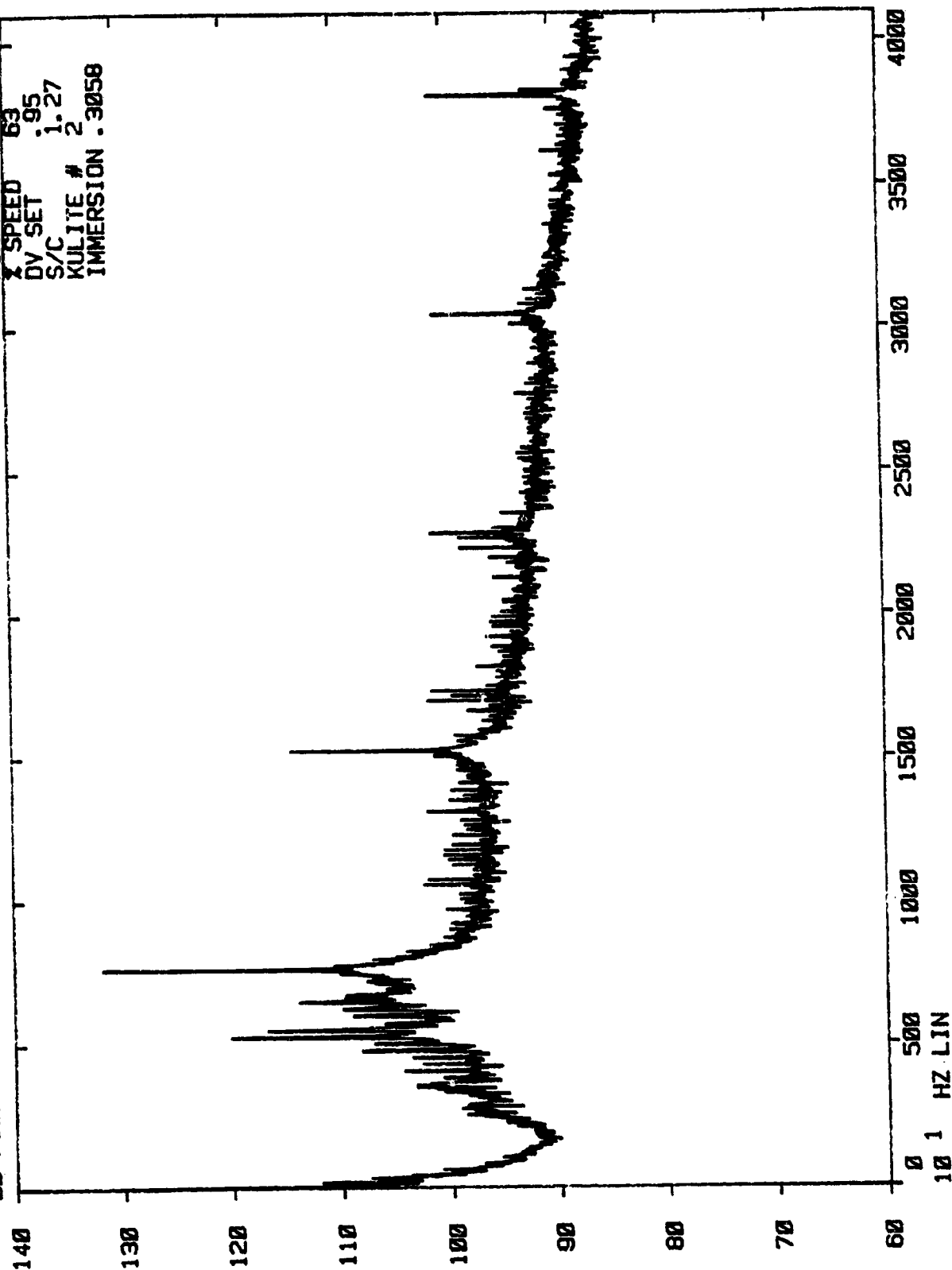
DB POWER SPEC. $\Delta f = 20\text{Hz}$



NASA V/B STUDY KULITE DATA

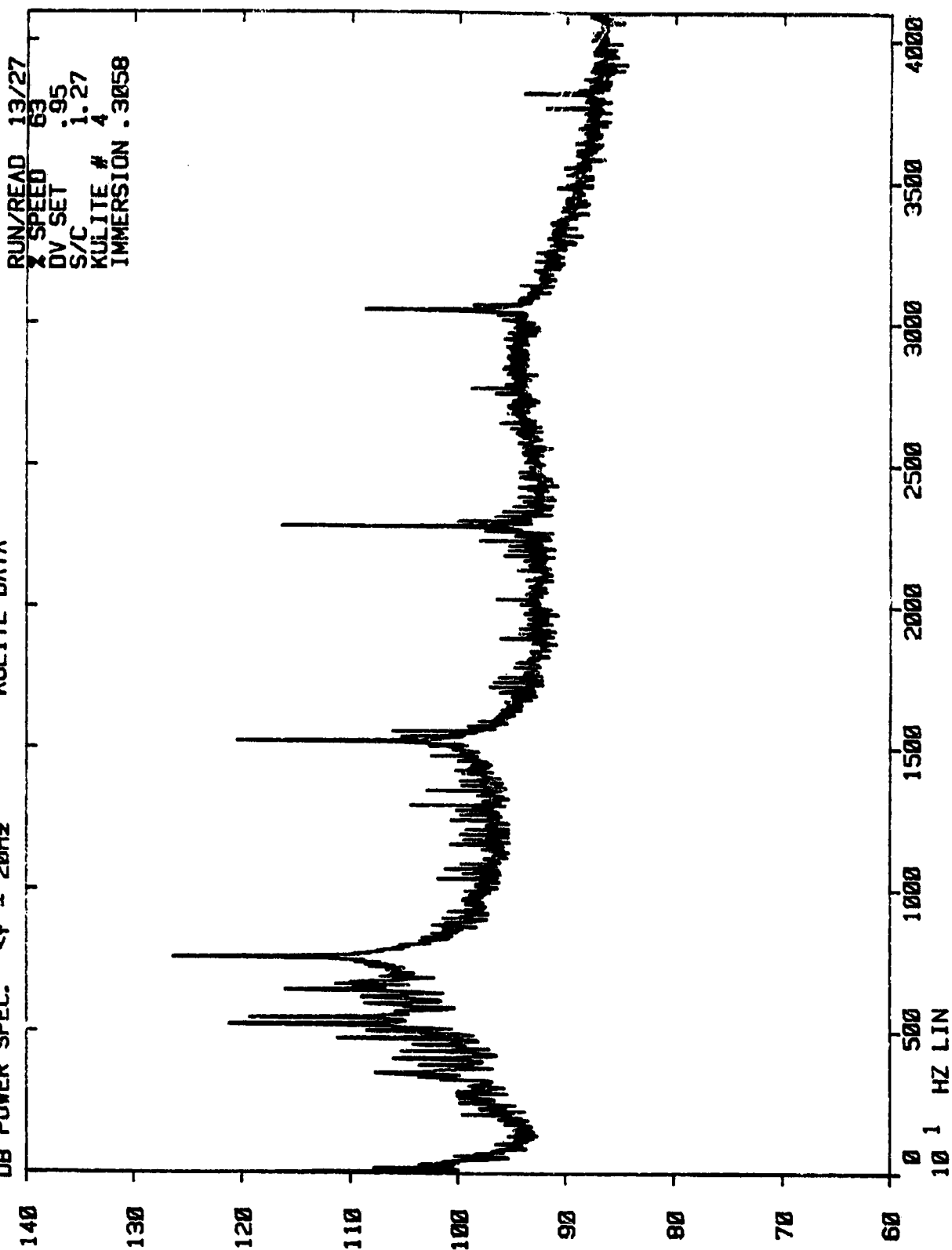
DB POWER SPEC. $\angle f = 20\text{Hz}$

RUN/READ 13/27
X SPEED 63
DV SET .95
S/C 1.27
KULITE # 2
IMMERSION .3058



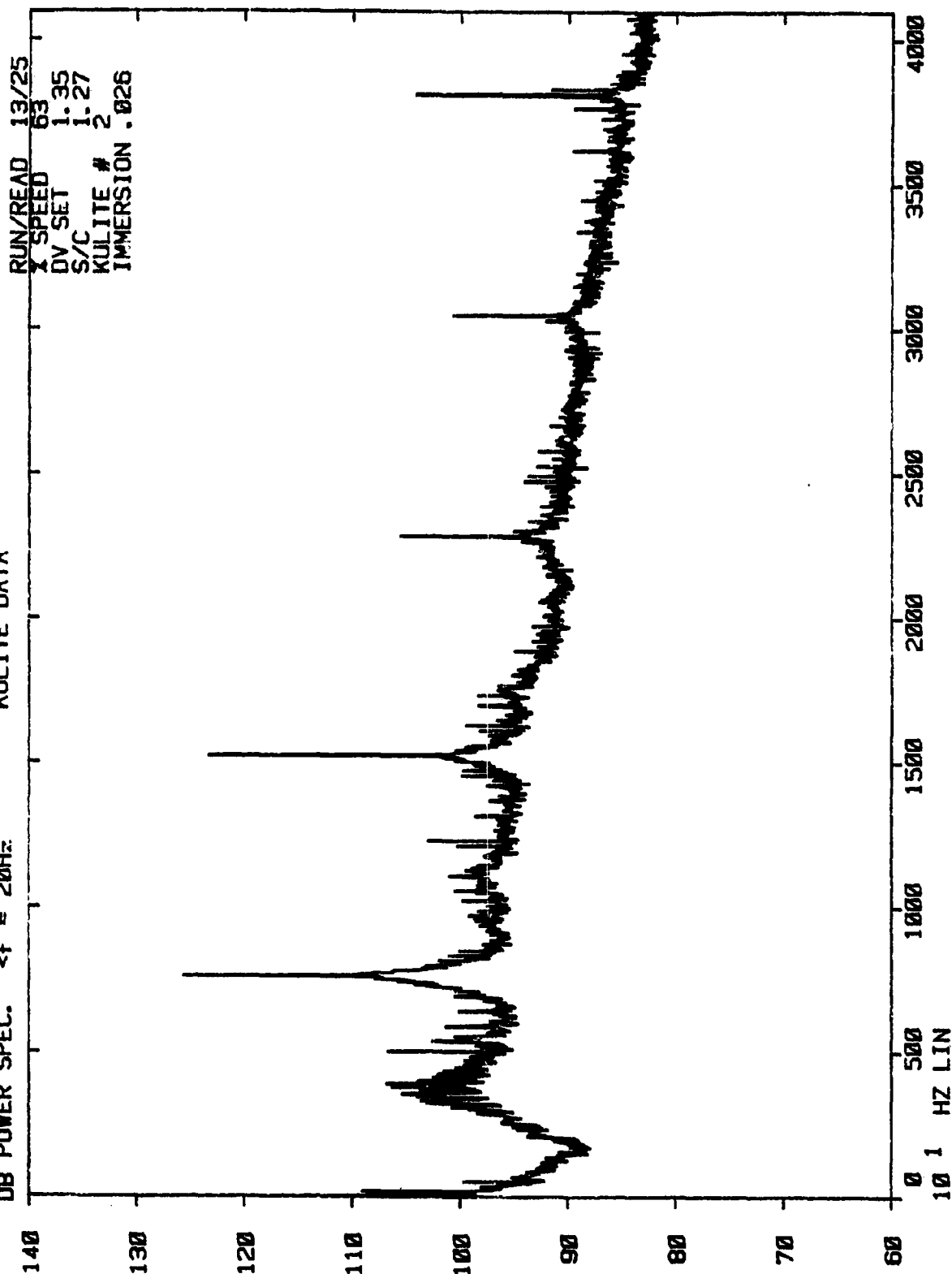
NASA V/B STUDY KULITE DATA

DB POWER SPEC. $\leq f = 20\text{Hz}$



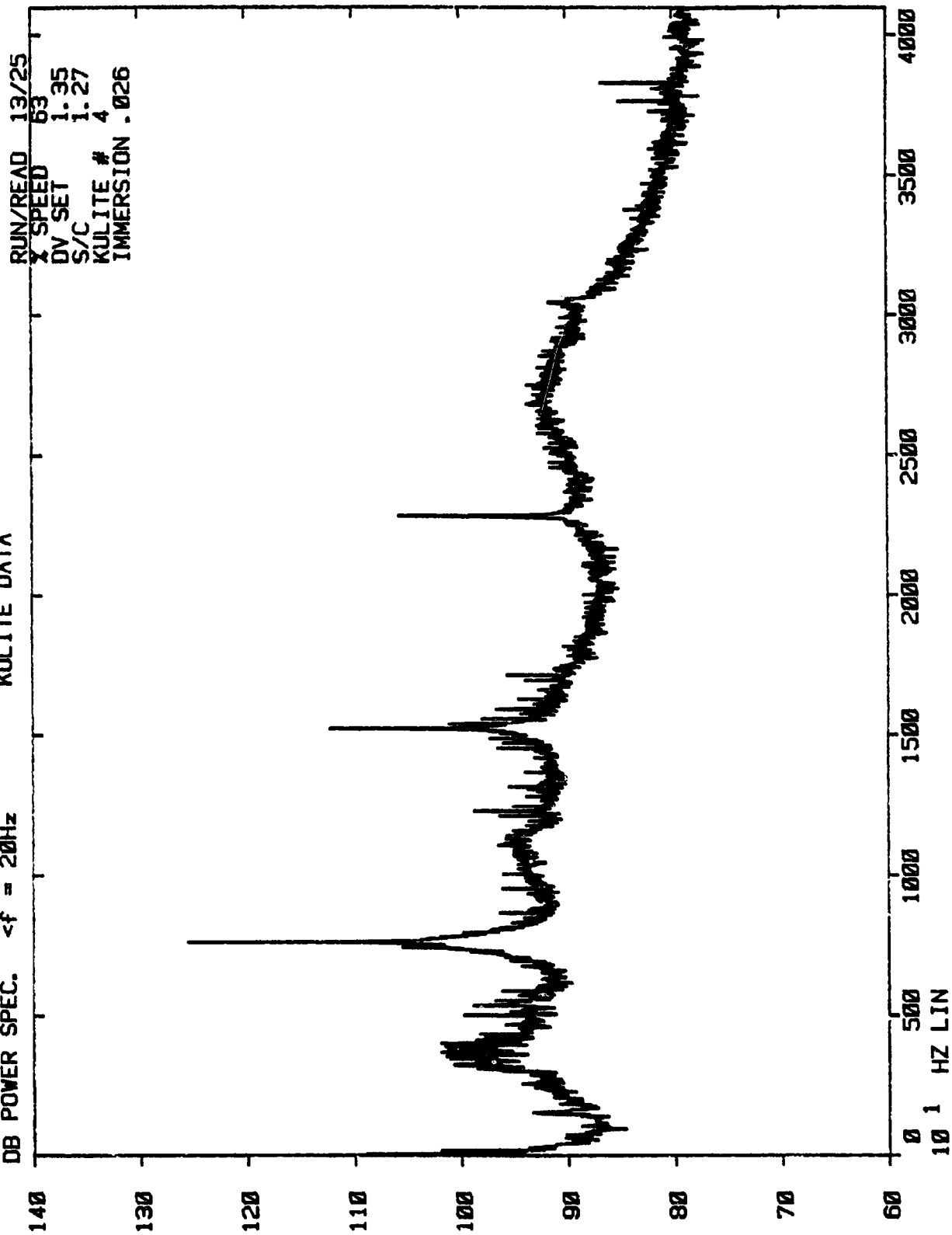
NASA V/B STUDY
KULITE DATA

DB POWER SPEC. $<f = 20\text{Hz}$



NASA V/B STUDY KULITE DATA

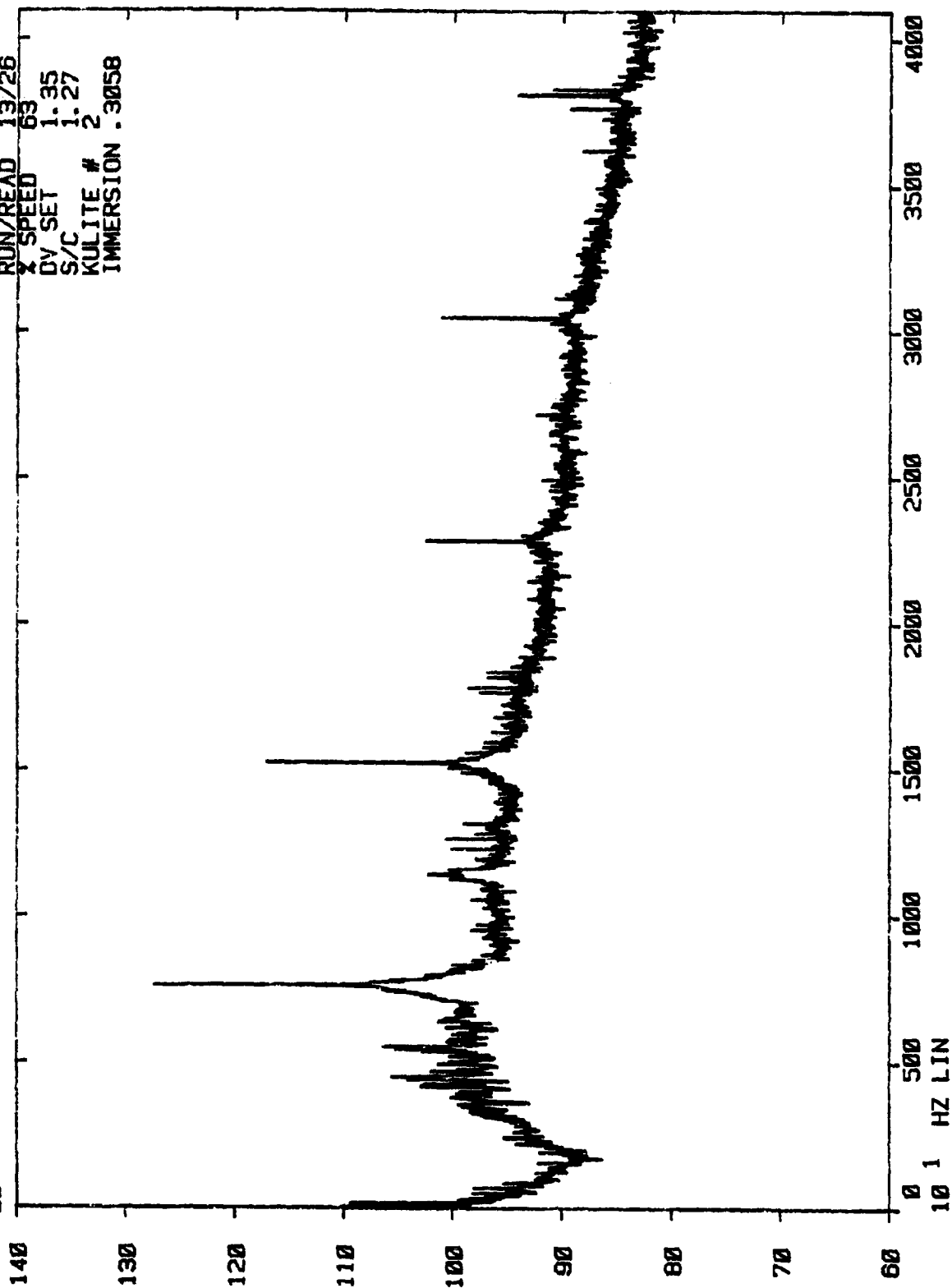
DB POWER SPEC. $< f = 20\text{Hz}$



NASA V/B STUDY KULITE DATA

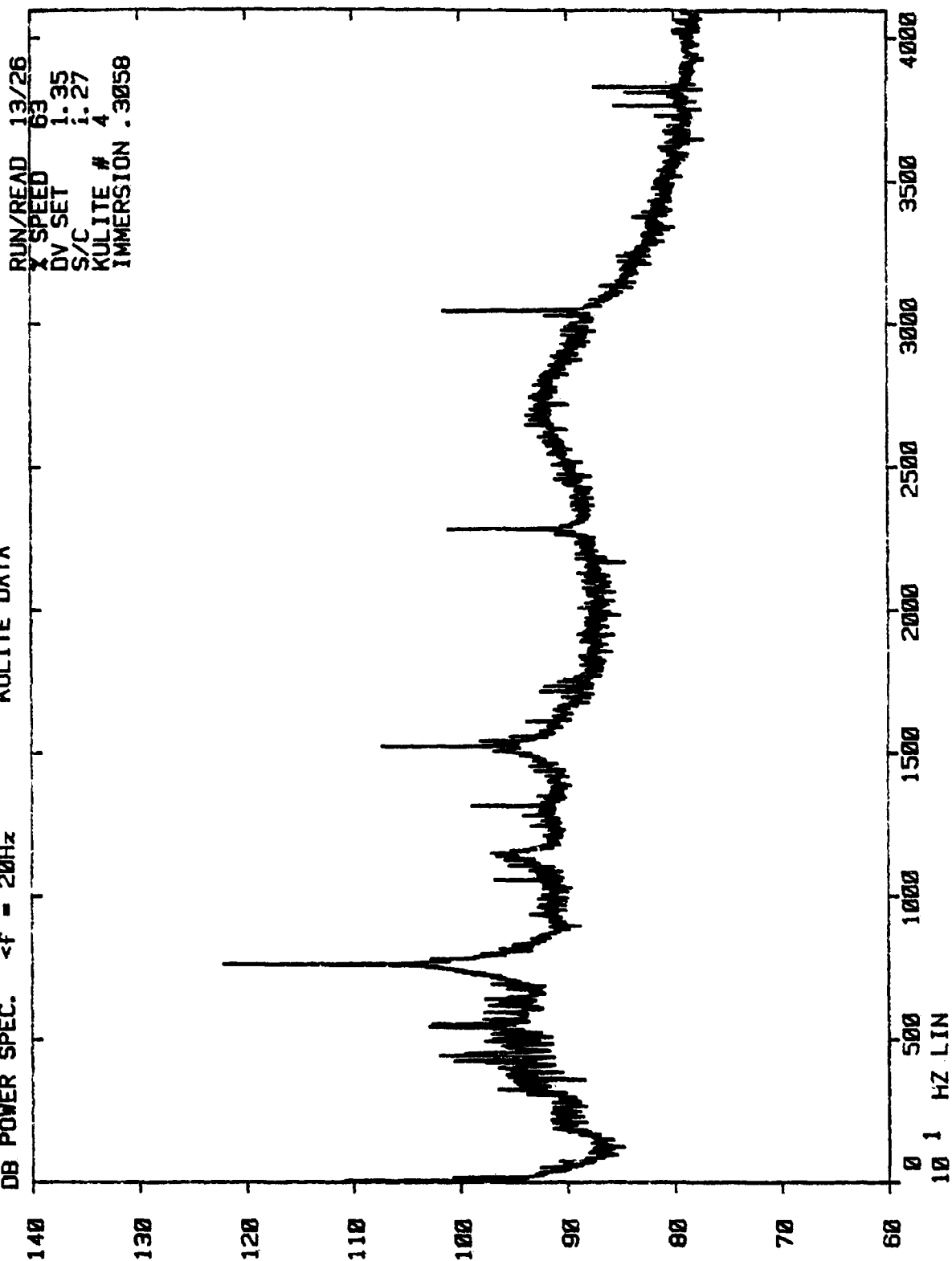
DB POWER SPEC. $\Delta f = 20\text{Hz}$

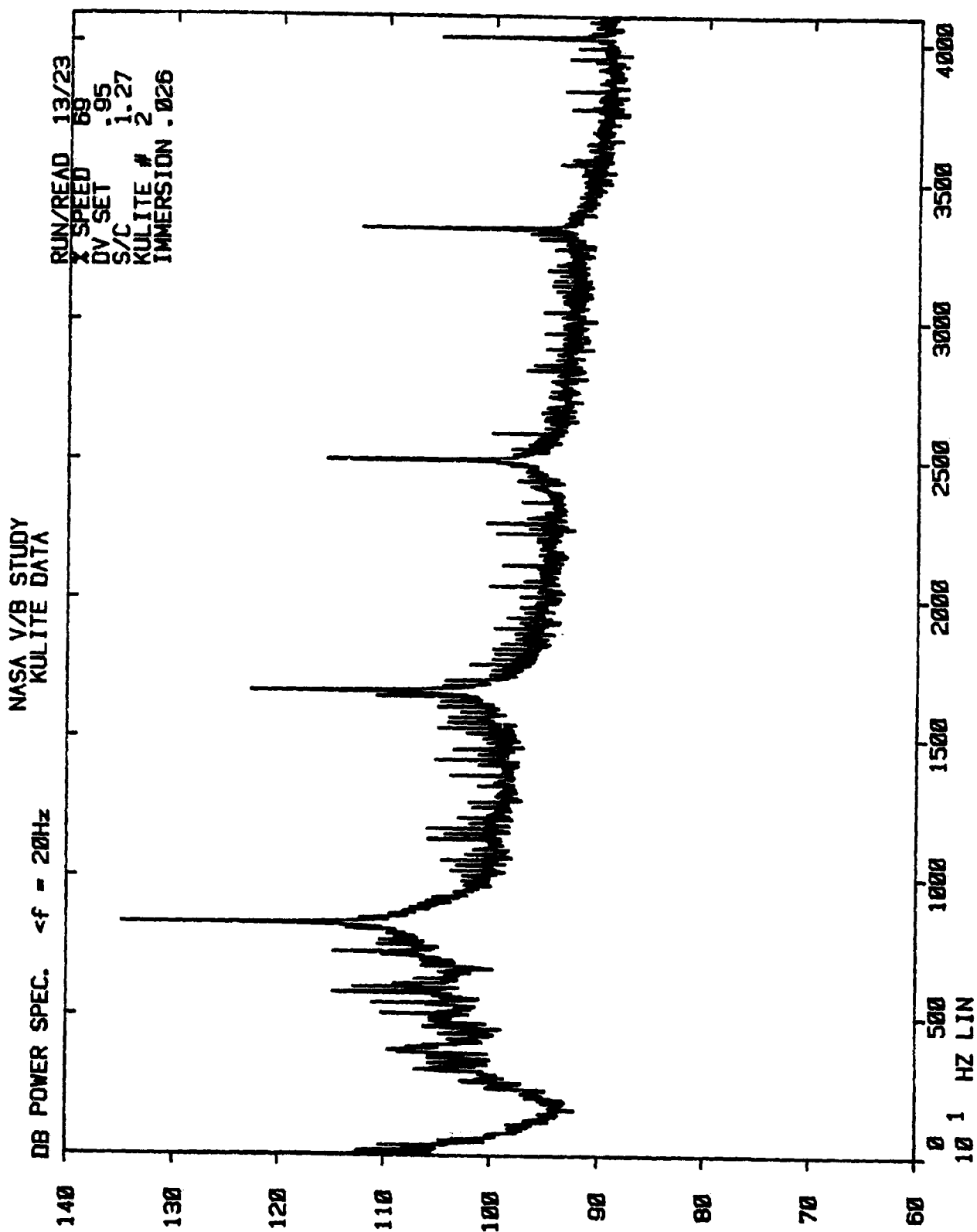
RUN/READ 13/26
X SPEED 63
DV SET 1.35
S/C 1.27
KULITE # 2
IMMERSION .3058



NASA V/B STUDY KULITE DATA

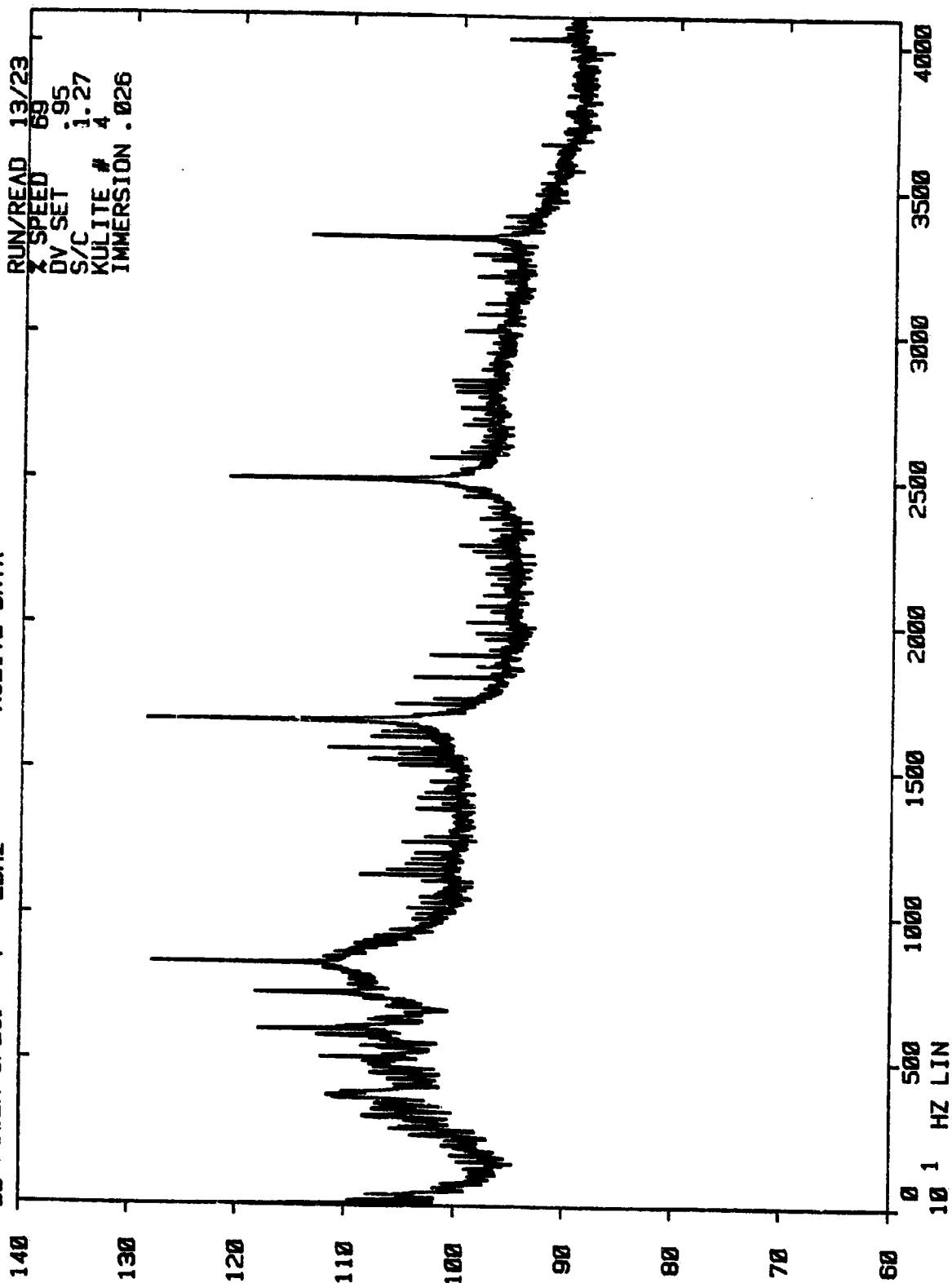
DB POWER SPEC. <f = 20Hz





NASA V/B STUDY
KULITE DATA

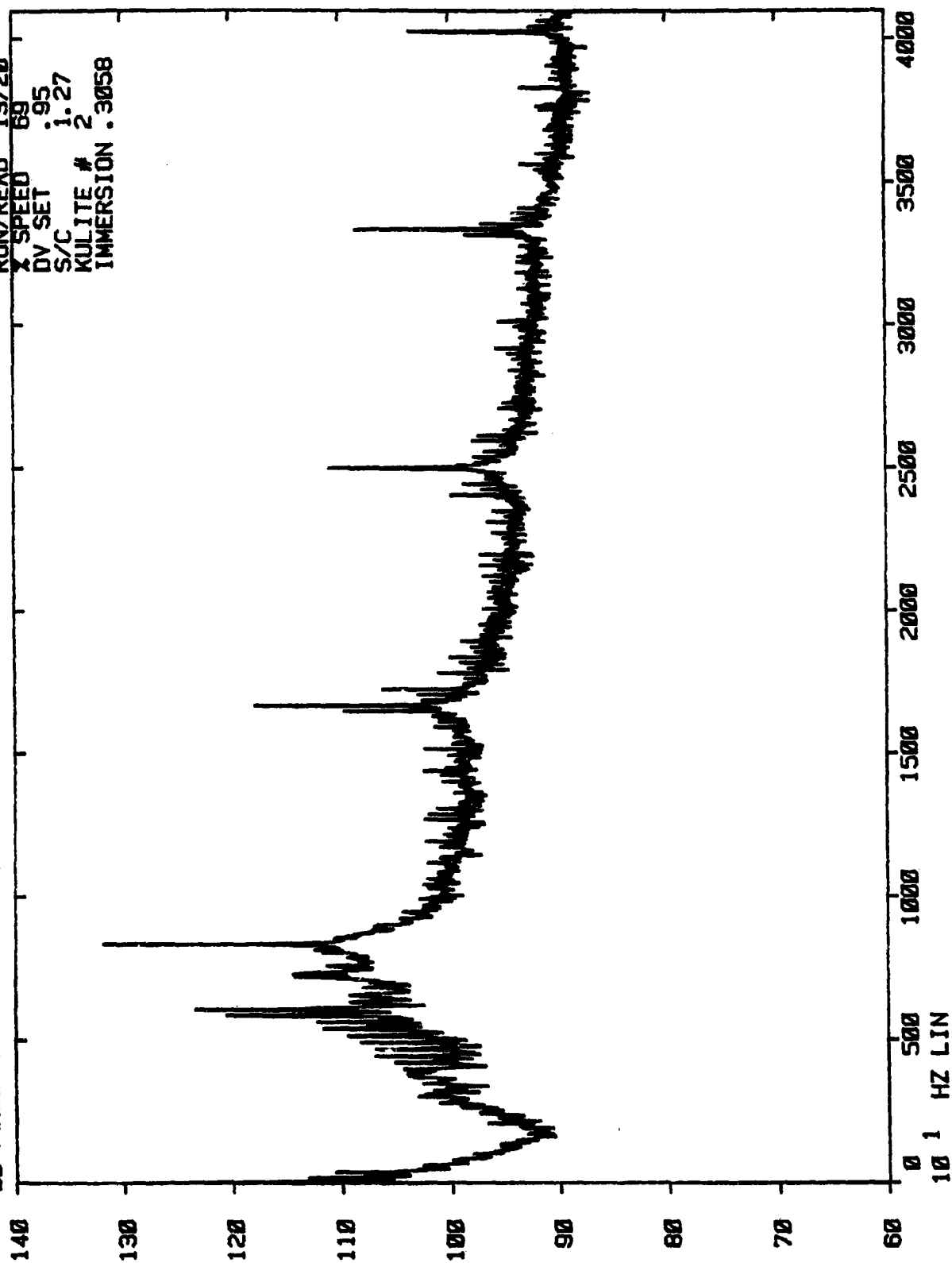
DB POWER SPEC. $\Delta f = 20\text{Hz}$



NASA V/B STUDY KULITE DATA

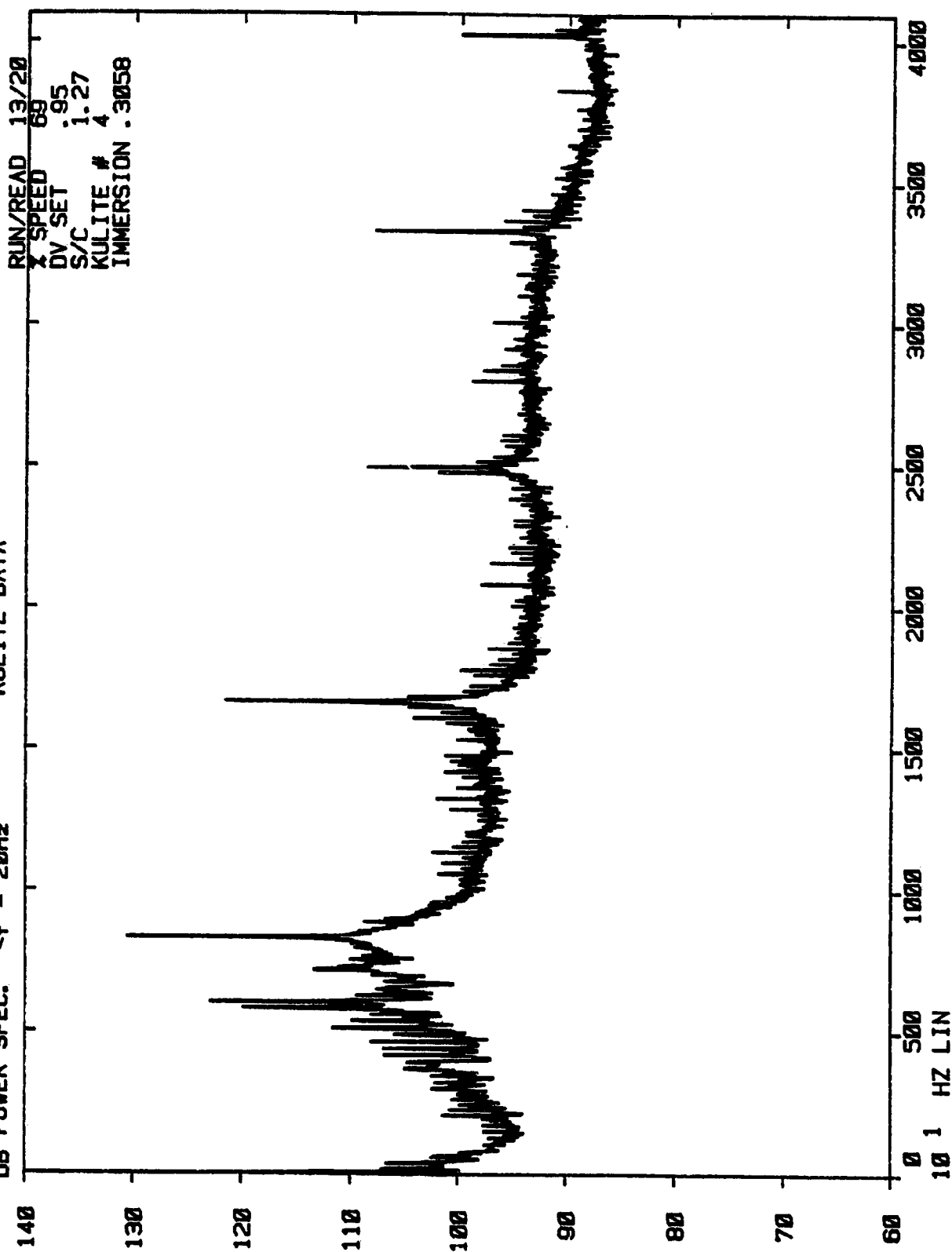
DB POWER SPEC. $\Delta f = 20\text{Hz}$

RUN/READ 13/20
X SPEED 69
DV SET .95
S/C 1.27
KULITE # 2
IMMERSION .3058



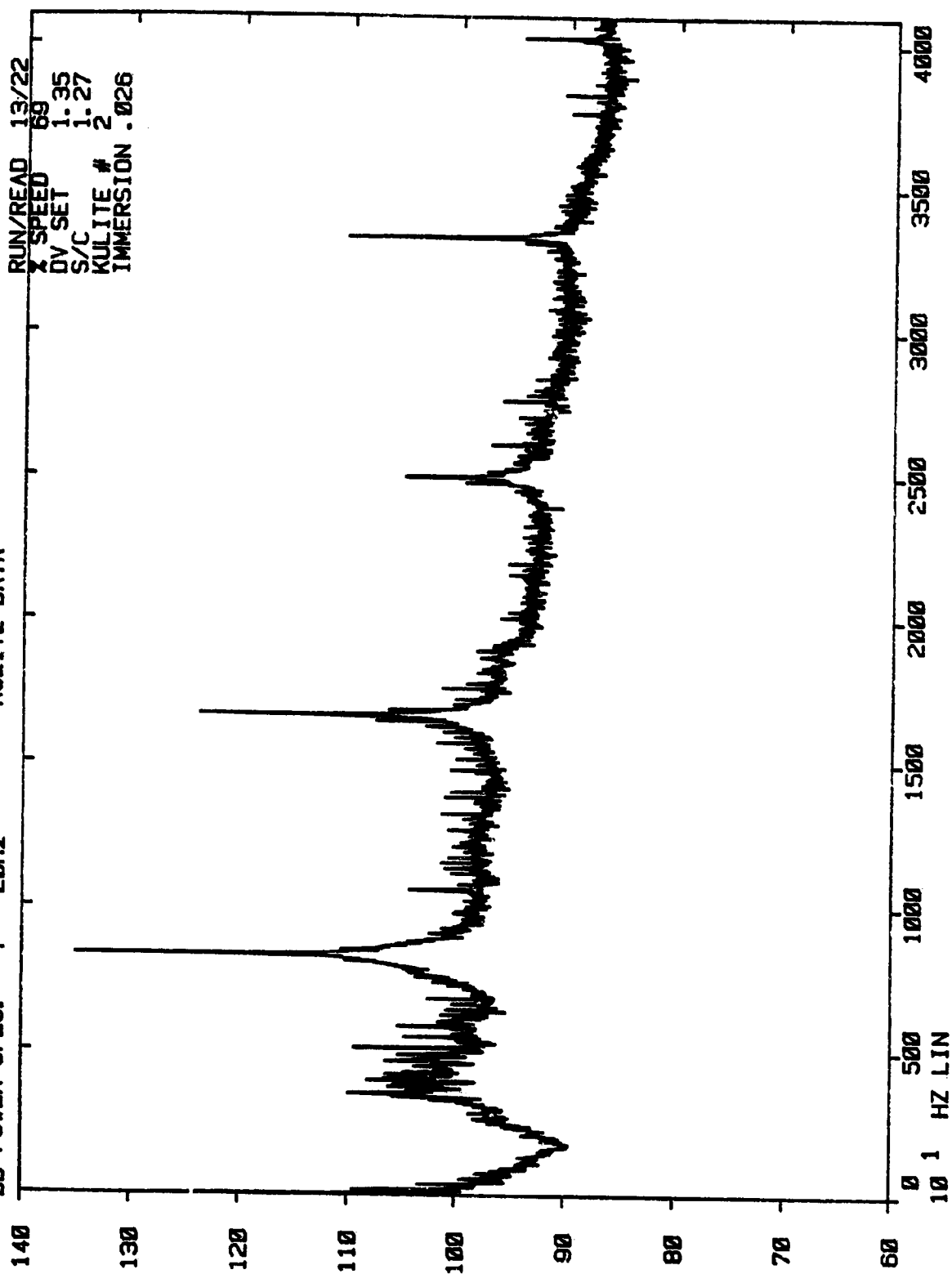
NASA V/B STUDY
KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$



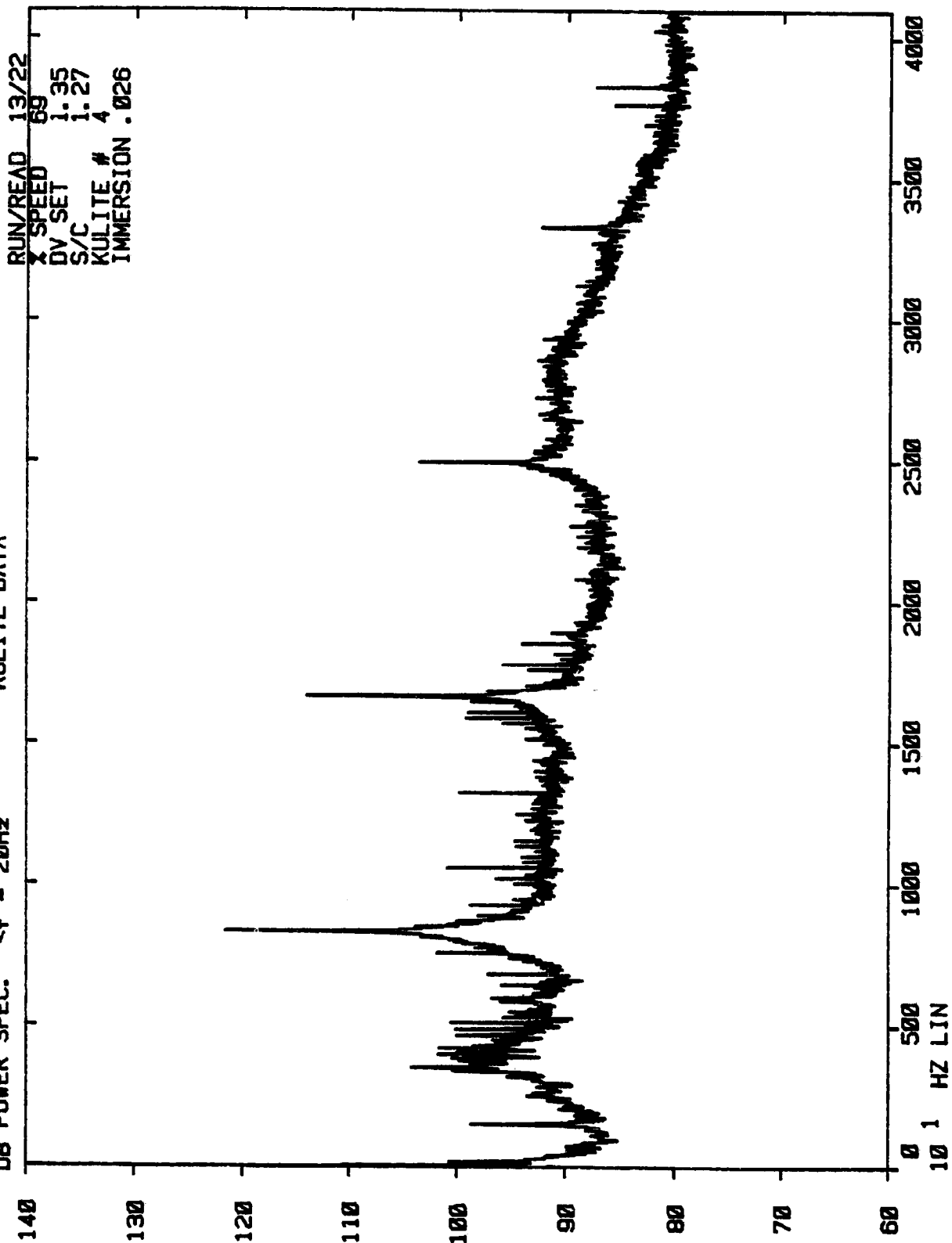
NASA V/B STUDY
KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$



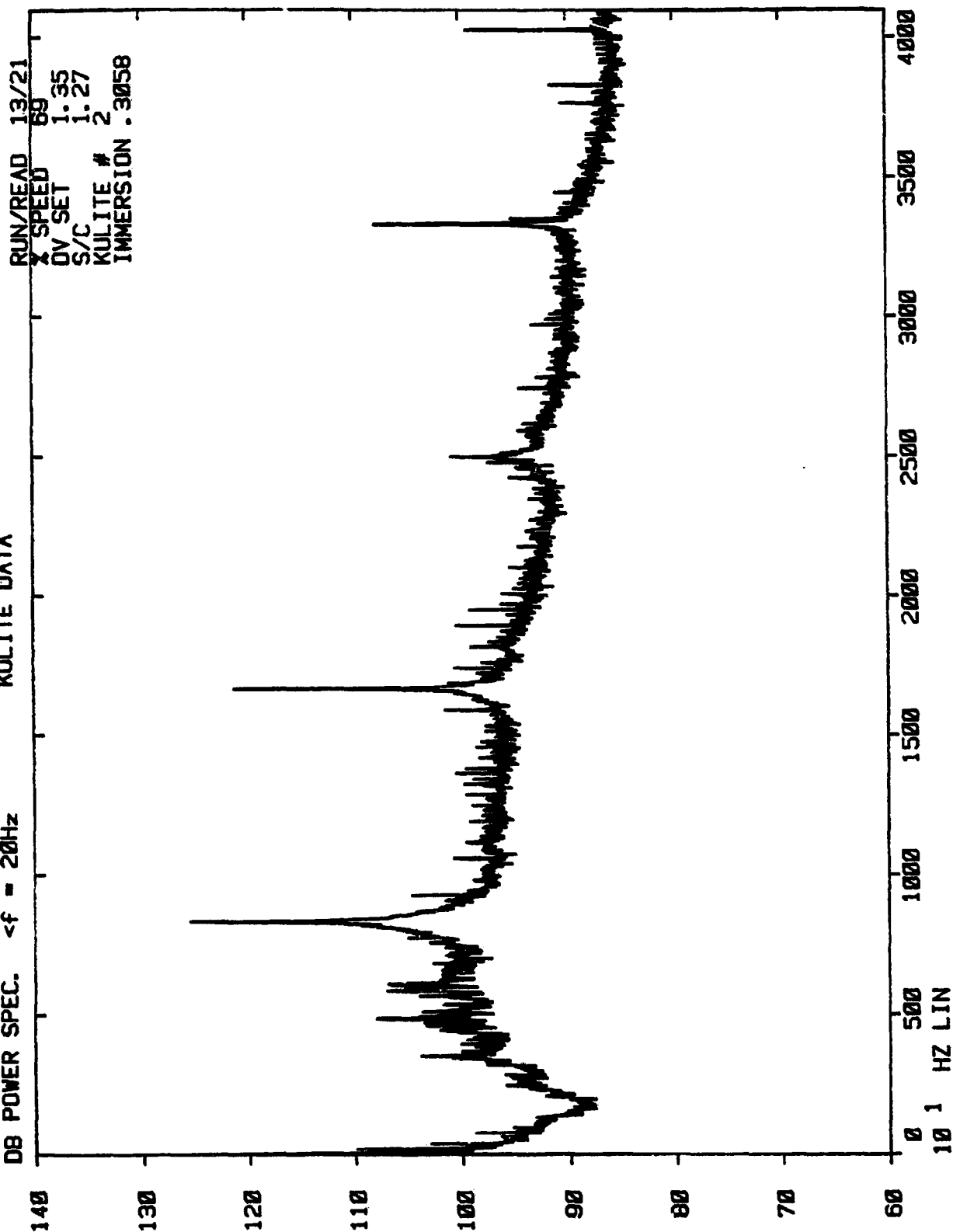
NASA V/B STUDY KULITE DATA

DB POWER SPEC. $< f = 20\text{Hz}$



NASA V/B STUDY KULITE DATA

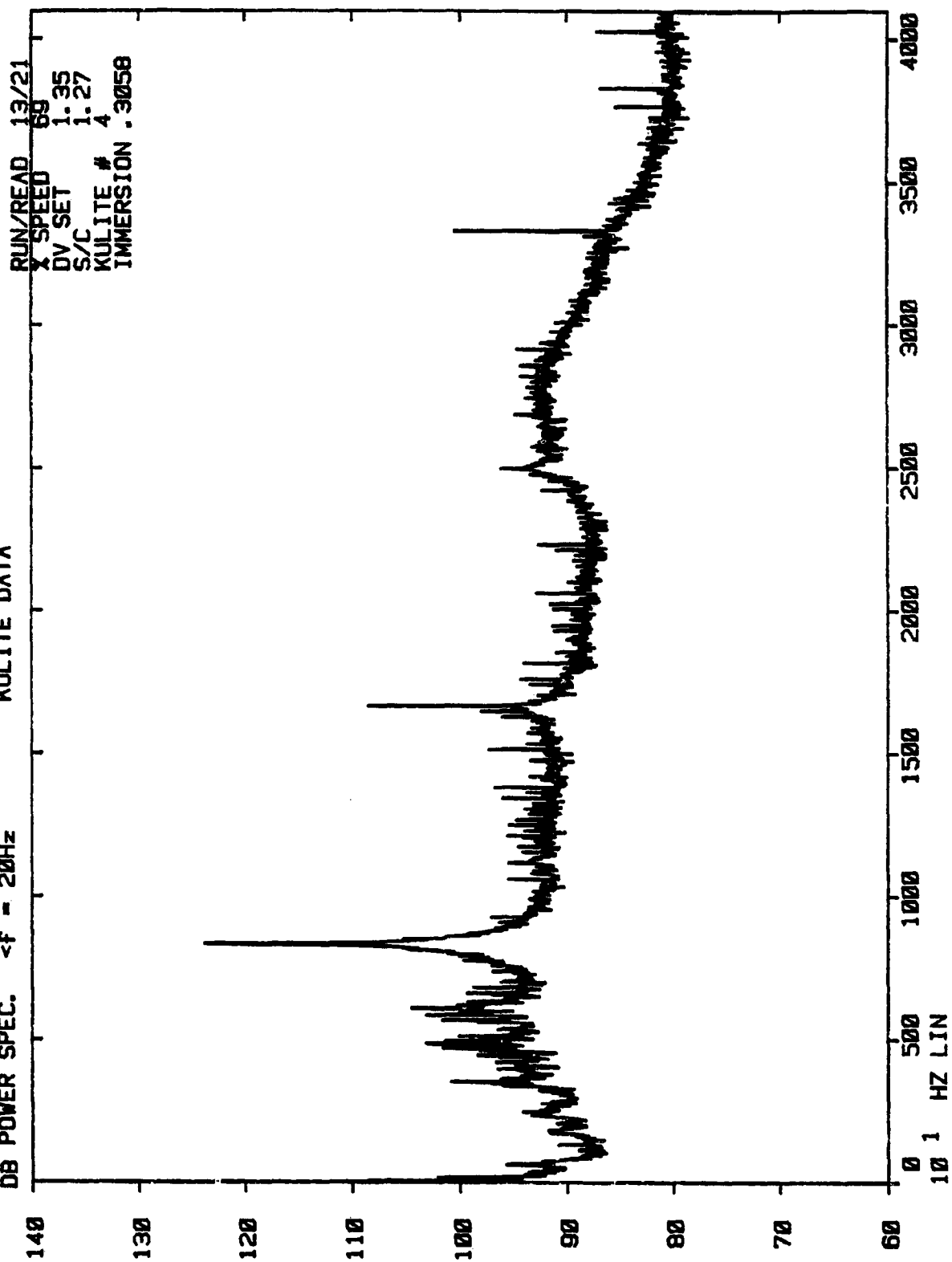
DB POWER SPEC. $\Delta f = 20\text{Hz}$



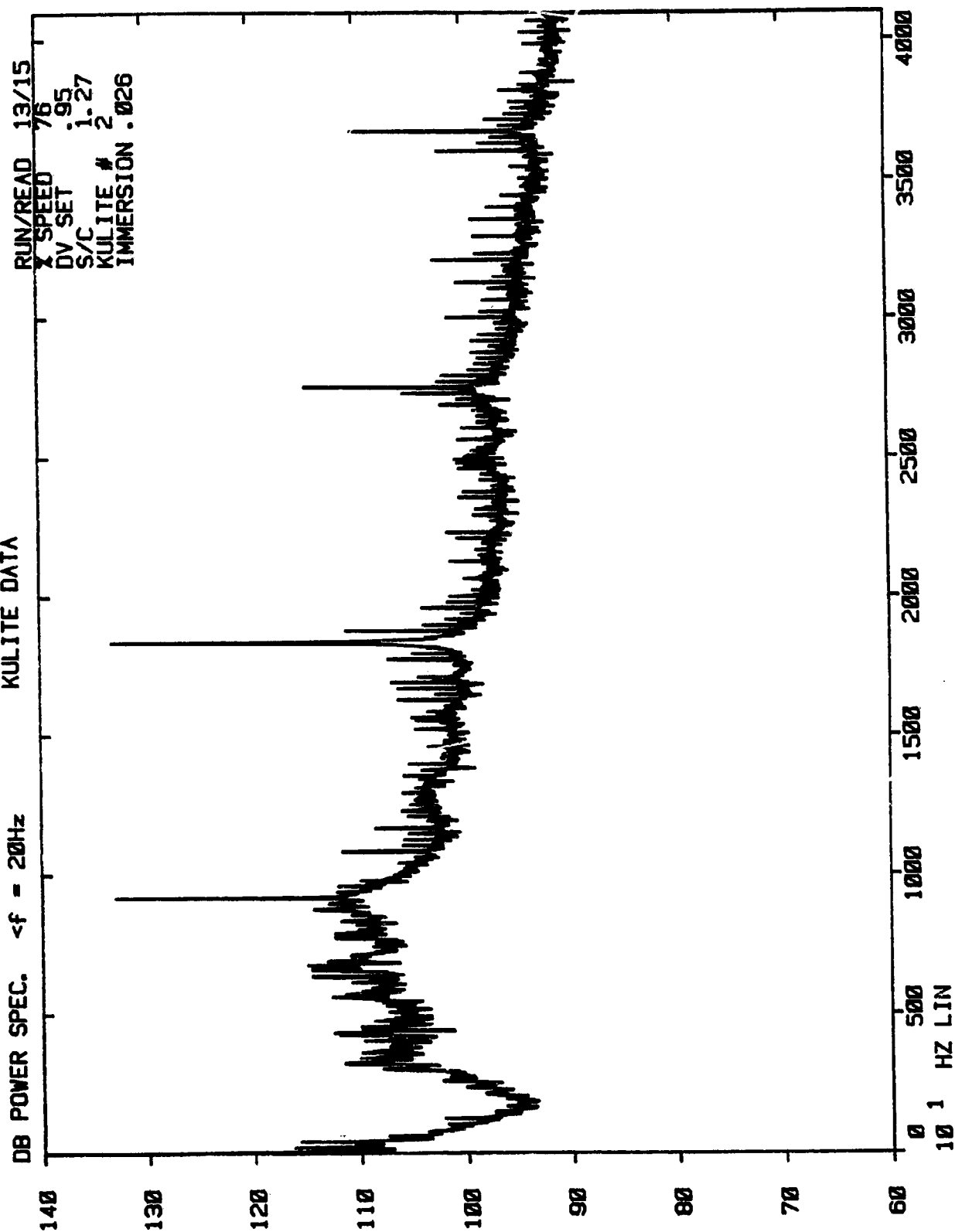
RUN/READ 13/21
SPEED 69
DV SET 1.35
S/C 1.27
KULITE # 2
IMMERSION .3058

NASA V/B STUDY
KULITE DATA

DB POWER SPEC. $<f = 20\text{Hz}$

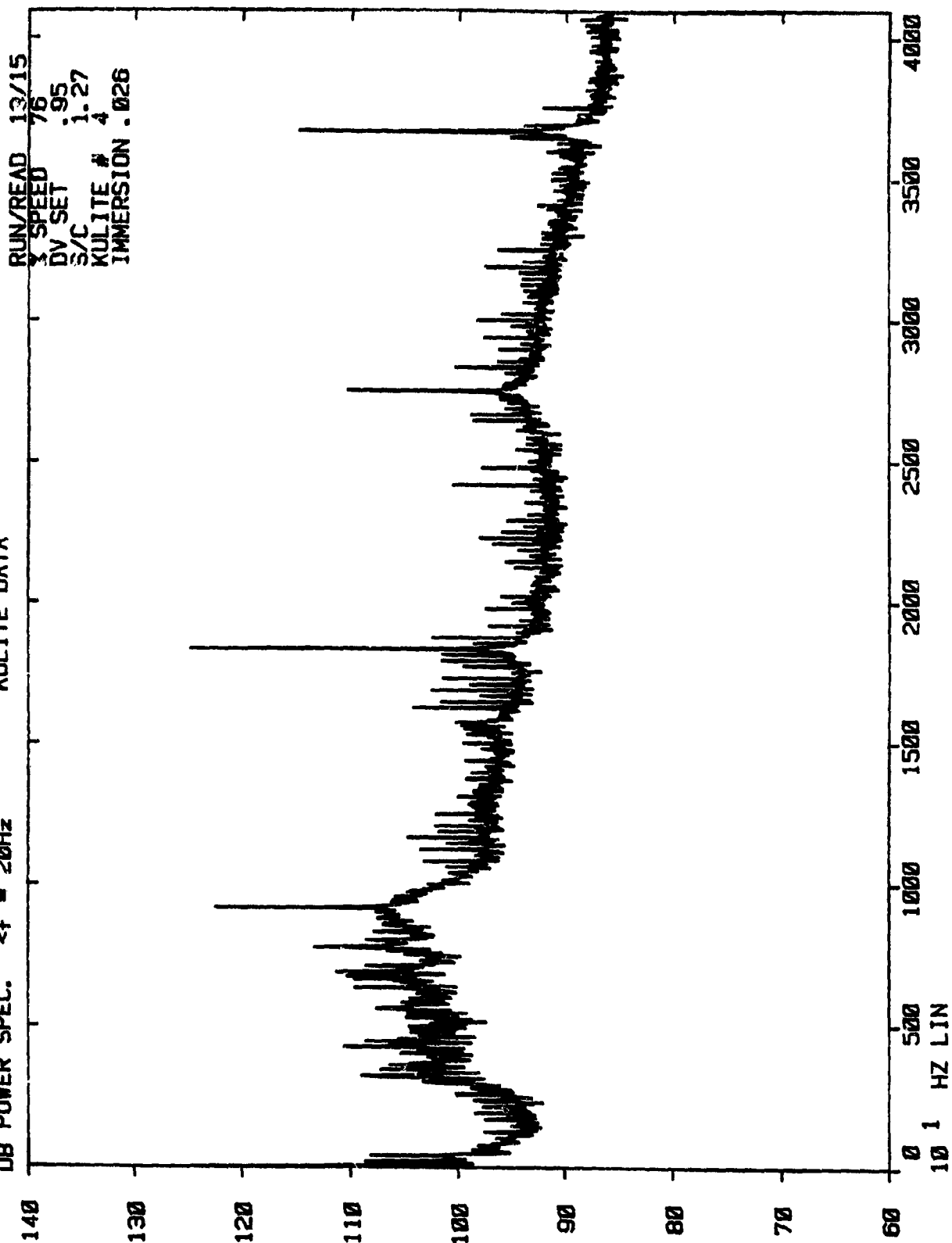


NASA V/B STUDY KULITE DATA



NASA V/B STUDY KULITE DATA

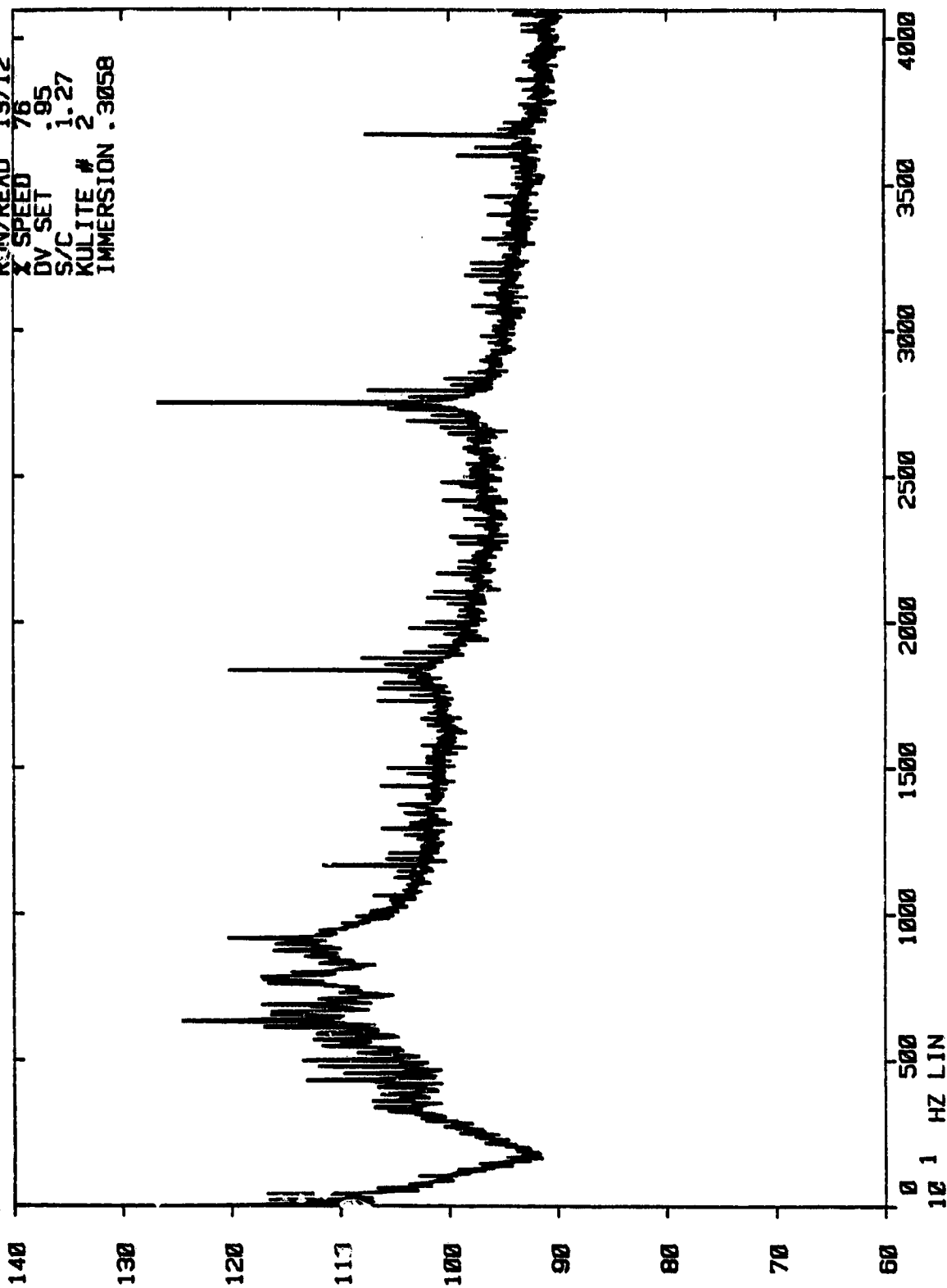
DB POWER SPEC. $\Delta f = 20\text{Hz}$



NASA V/B STUDY
KULITE DATA

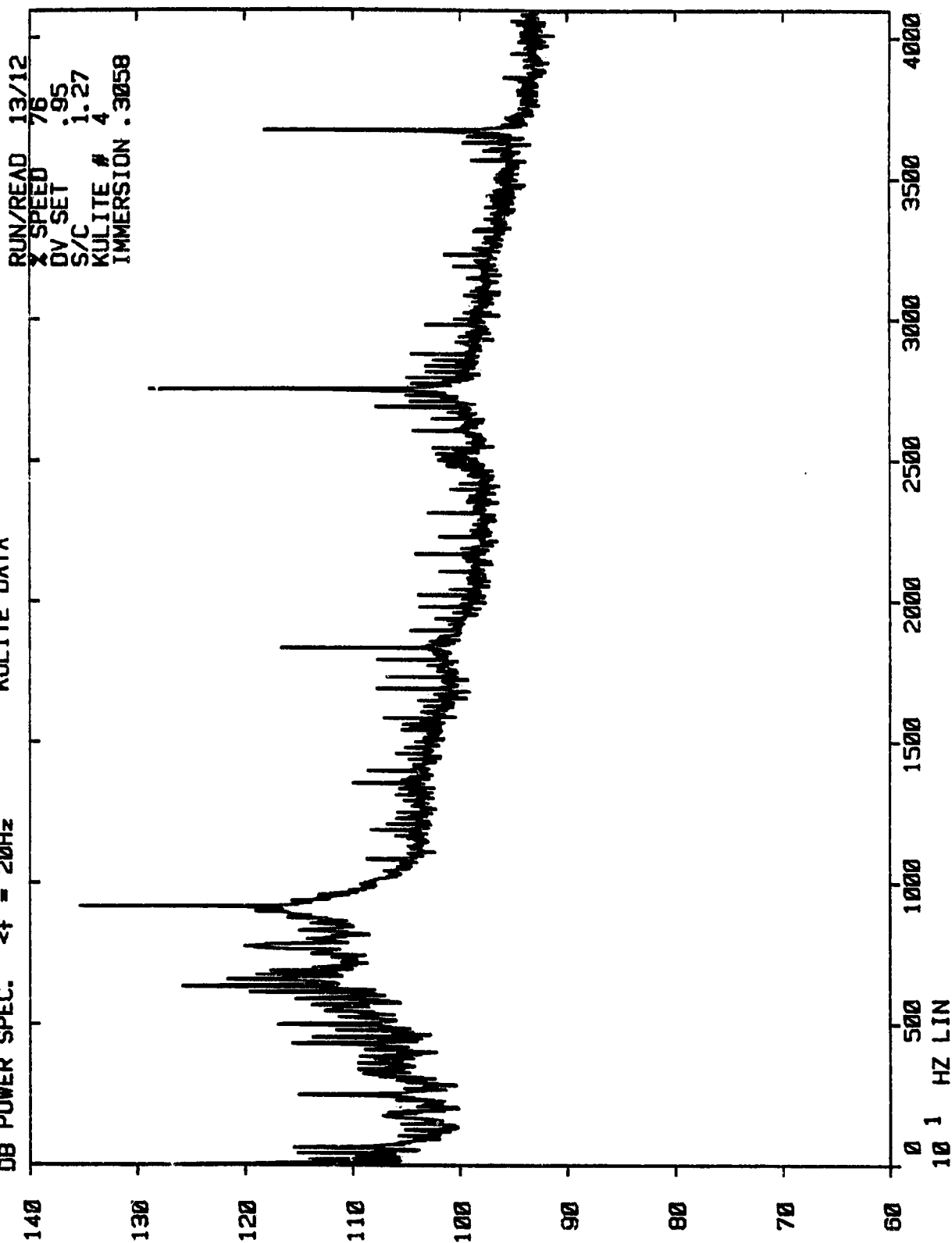
DB POWER SPEC. $\langle f = 20\text{Hz}$

RUN/READ 13/12
X SPEED 76
DV SET .95
S/C 1.27
KULITE # 2
IMMERSION .3058



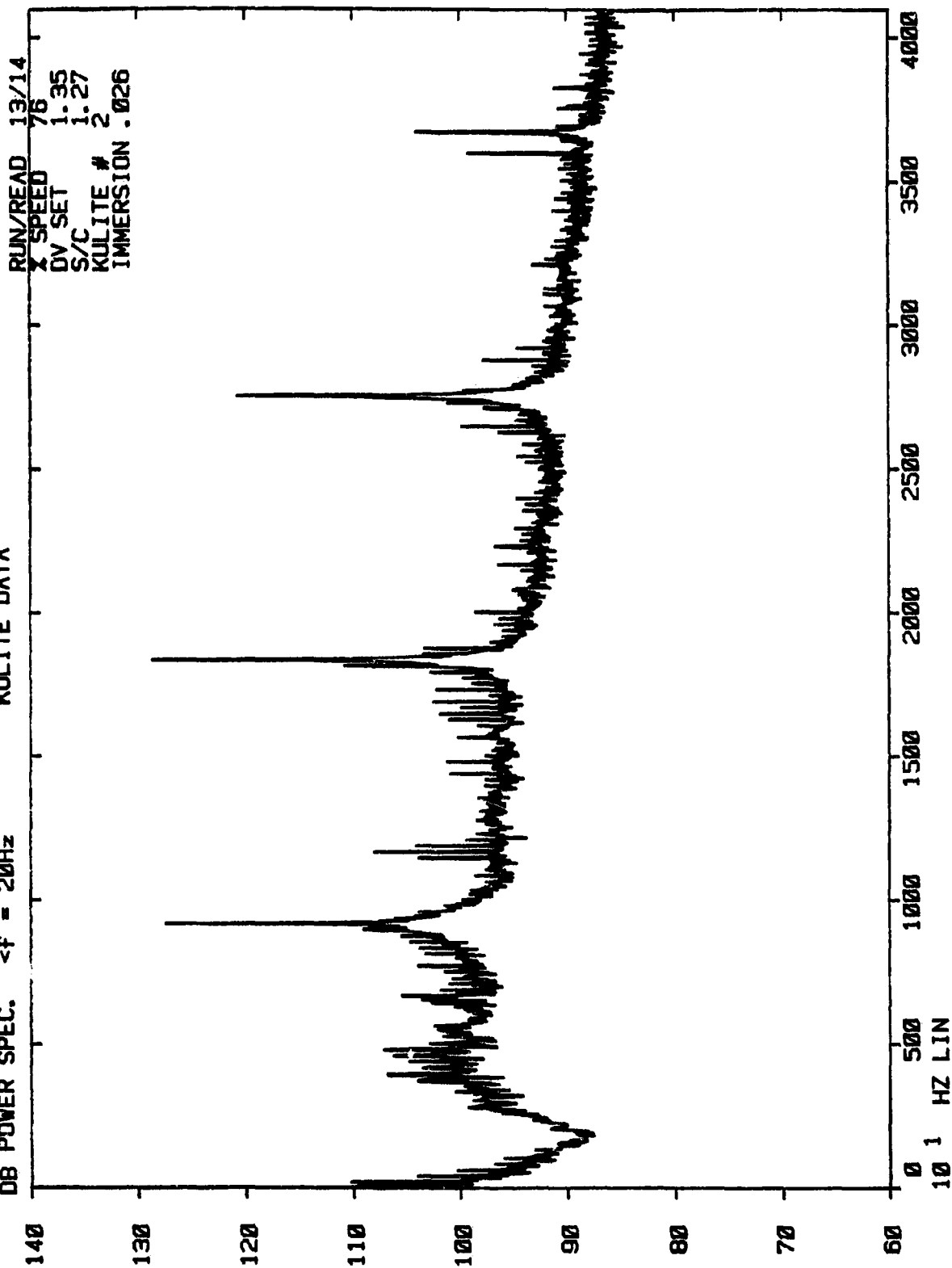
NASA V/B STUDY KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$



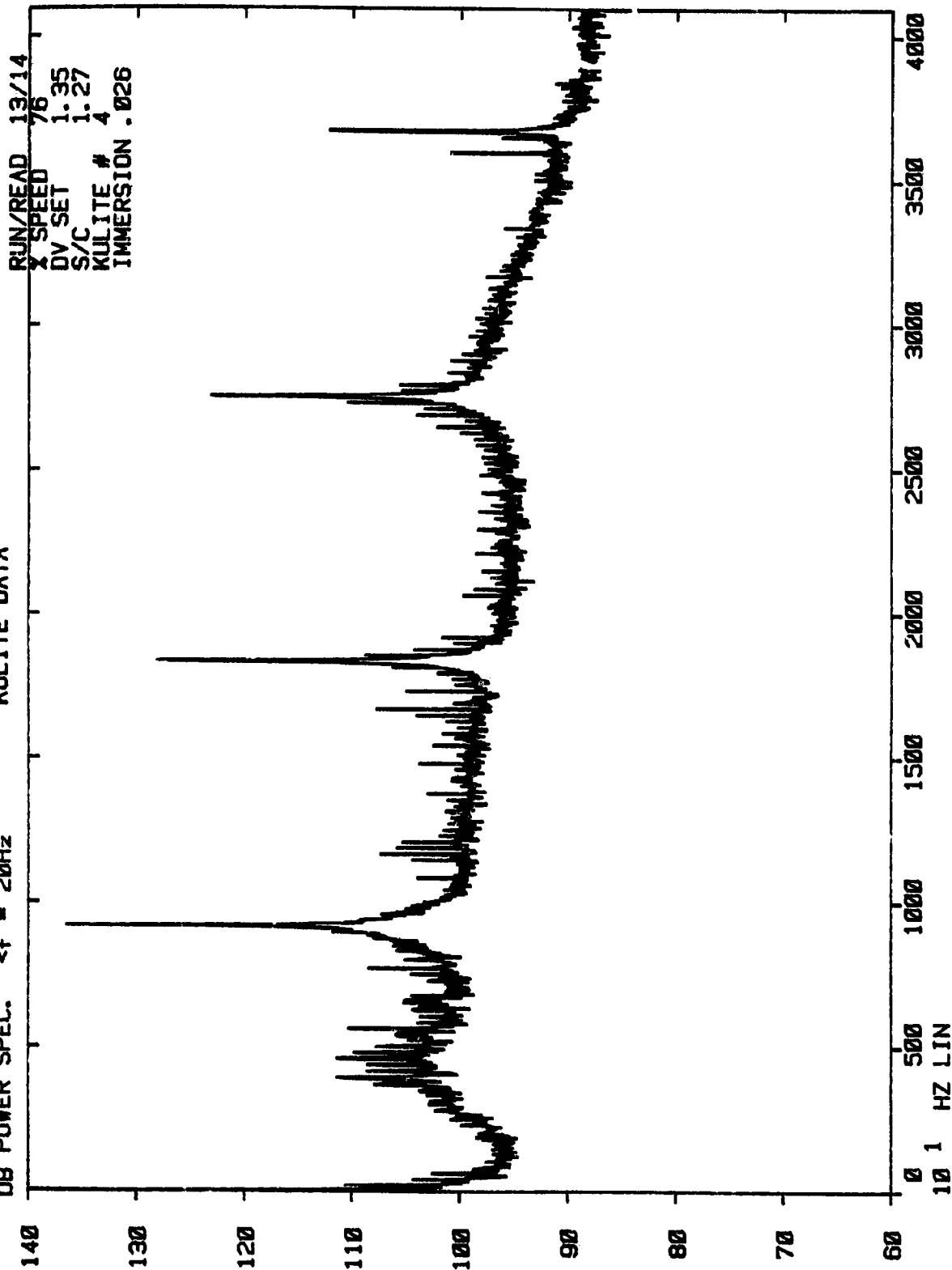
NASA V/B STUDY KULITE DATA

DB POWER SPEC. <f = 20Hz



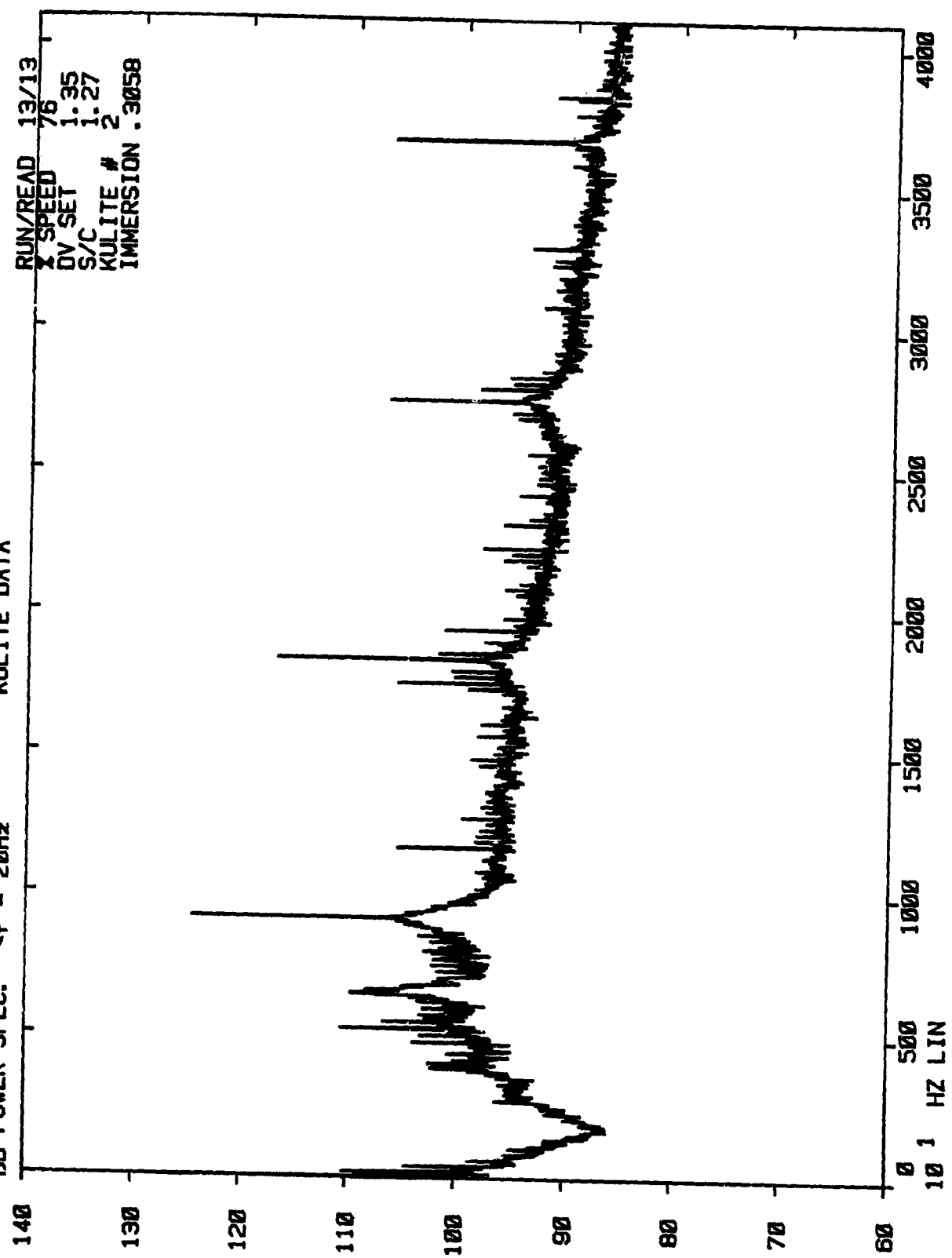
NASA V/B STUDY KULITE DATA

DB POWER SPEC. $<f = 20\text{Hz}$



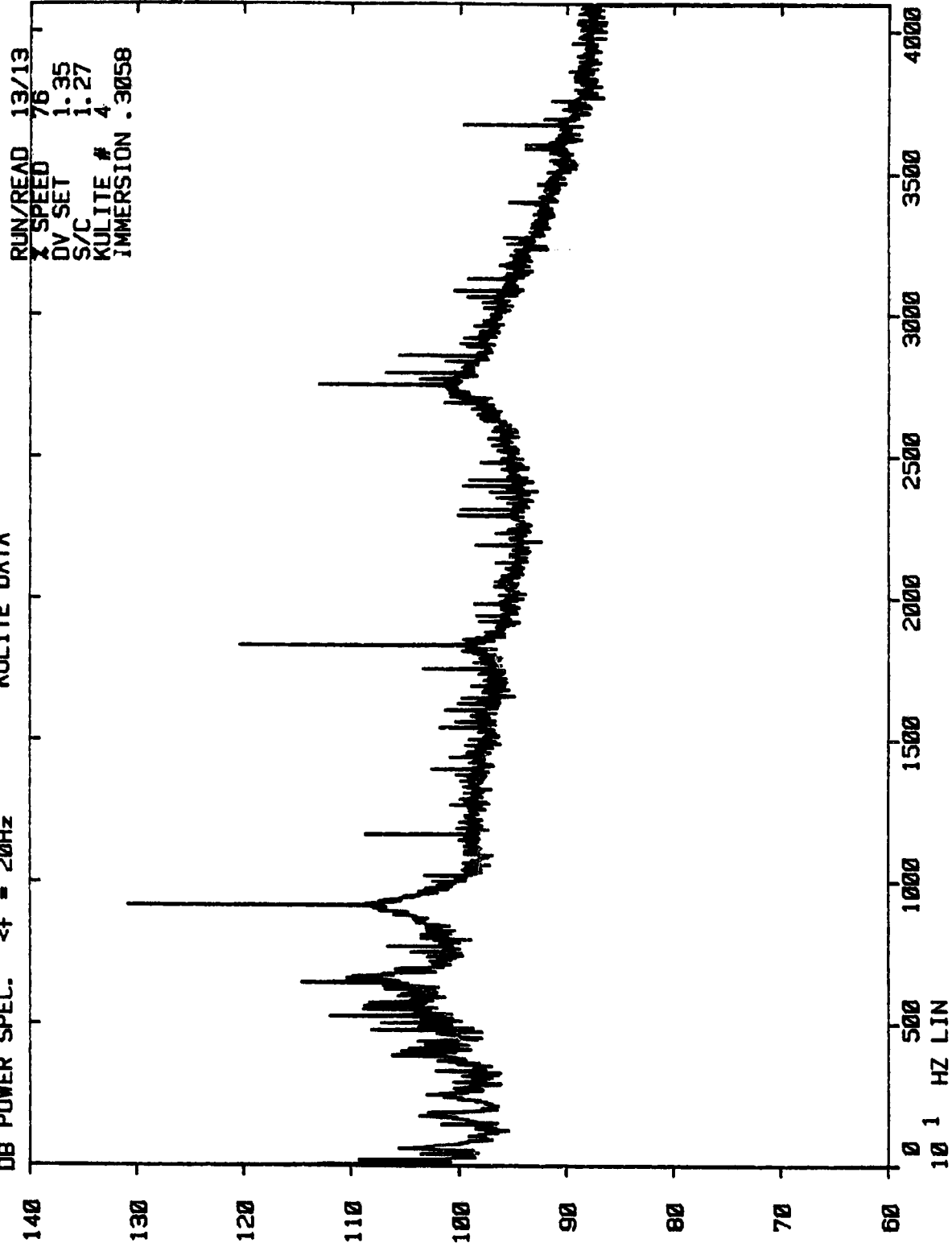
NASA V/B STUDY
KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$



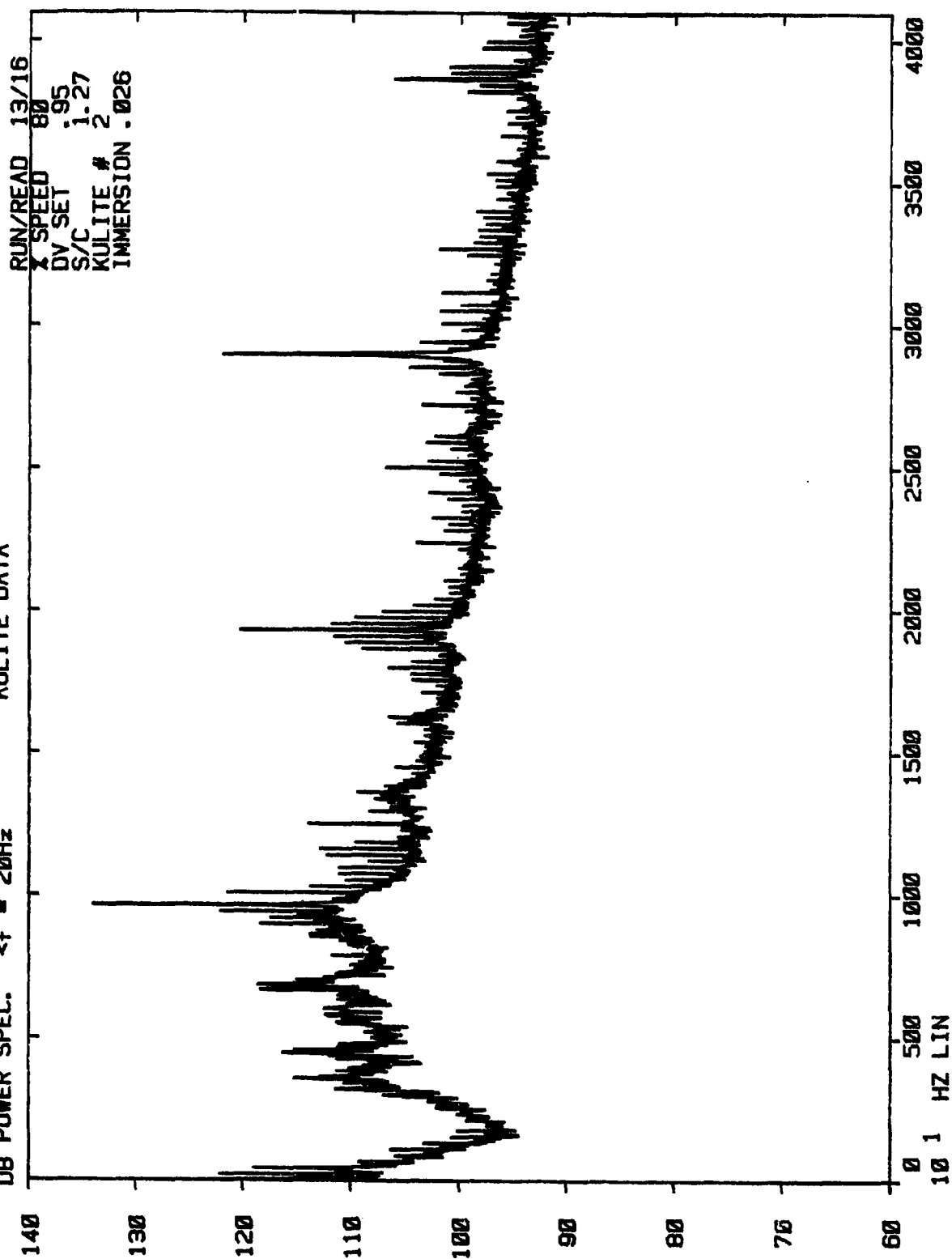
NASA V/B STUDY
KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$

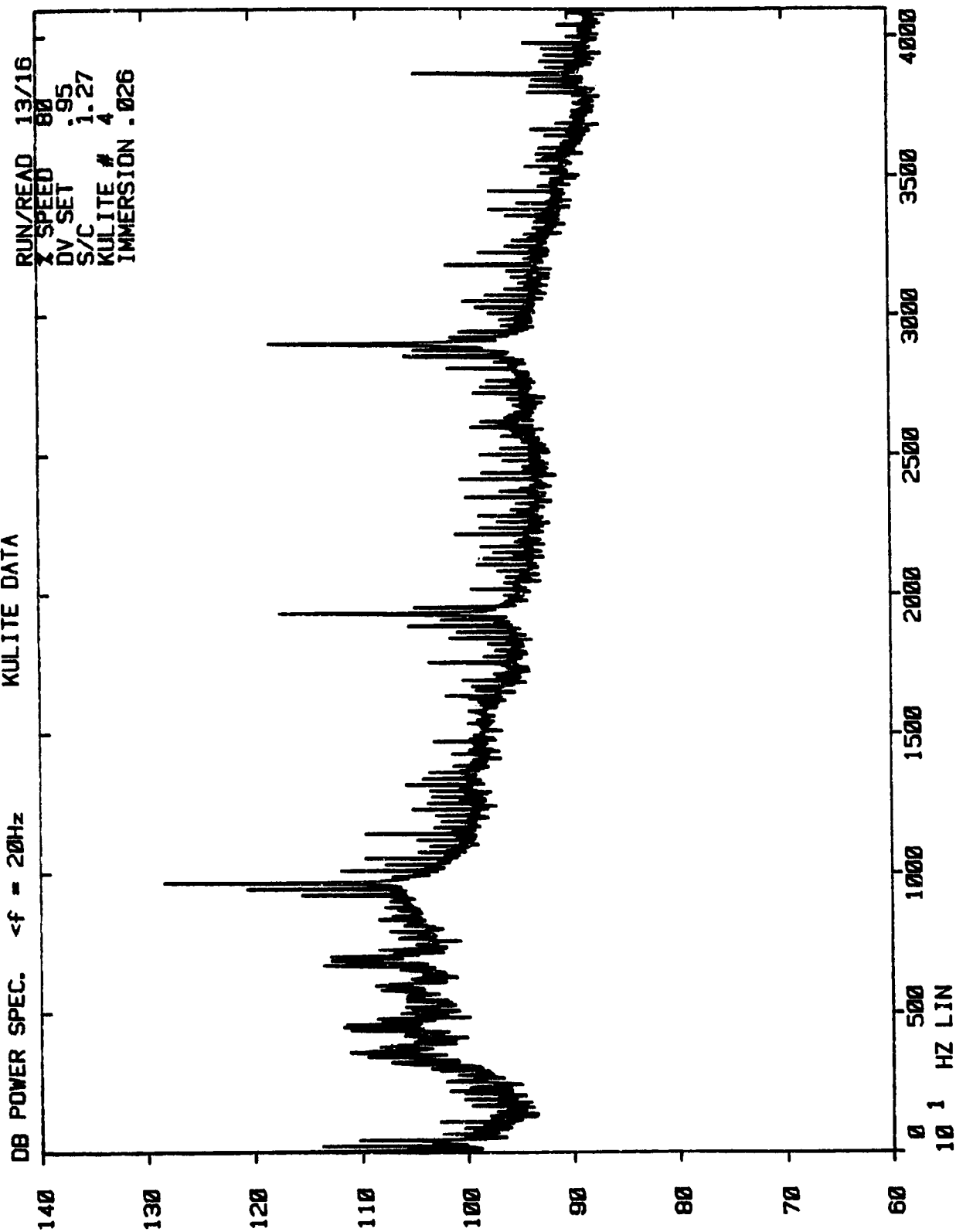


NASA V/B STUDY KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$

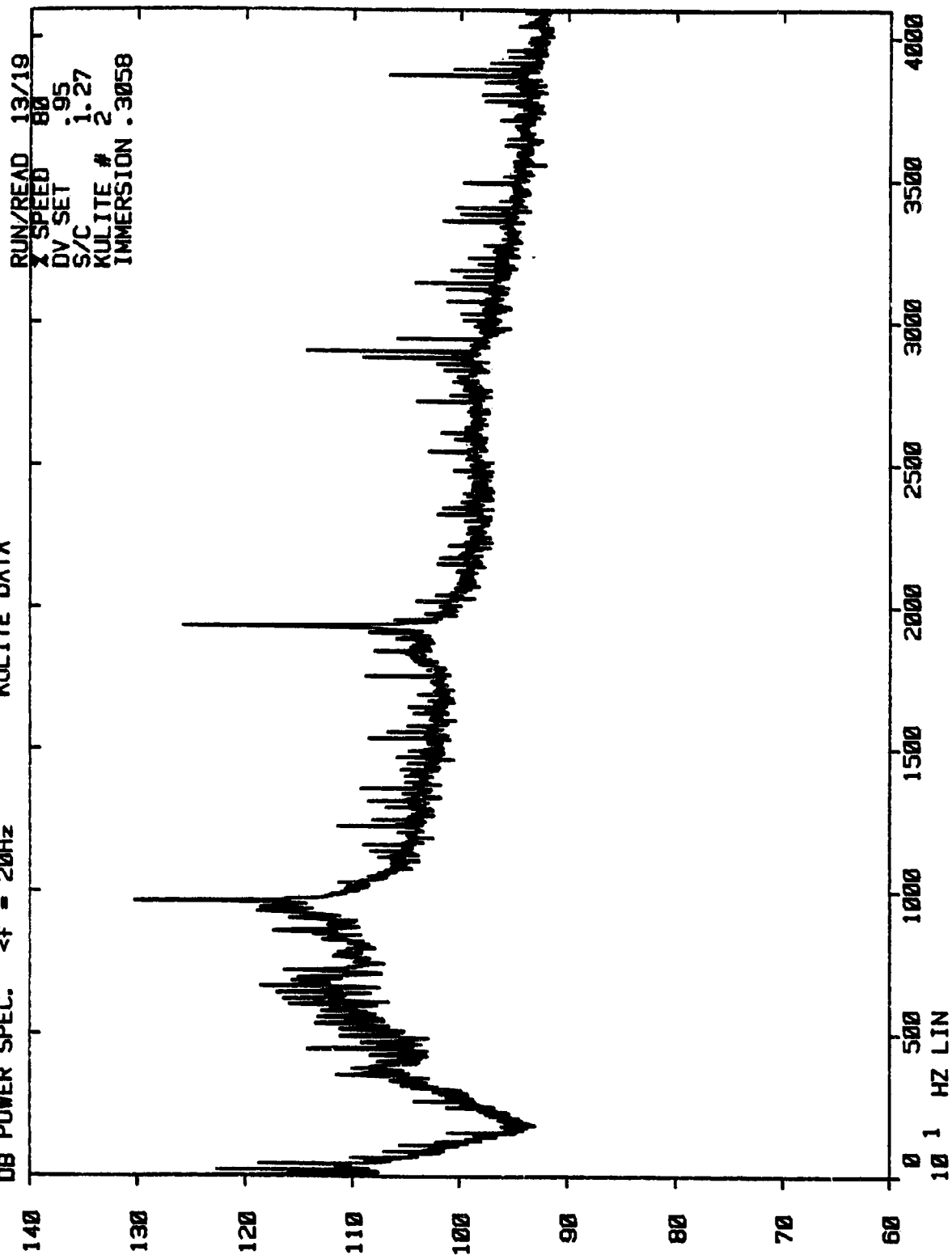


NASA V/B STUDY
KULITE DATA



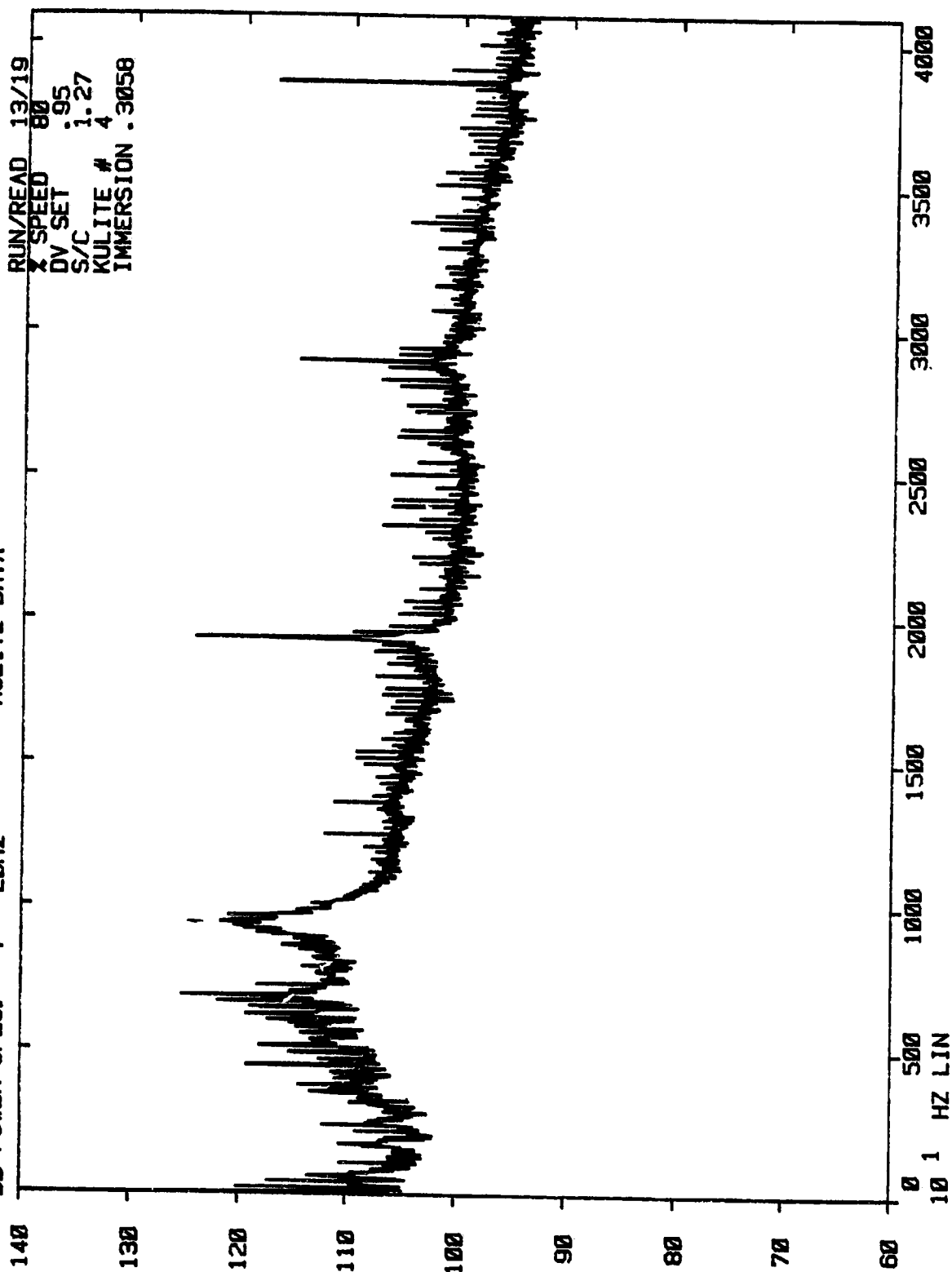
NASA V/B STUDY
KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$

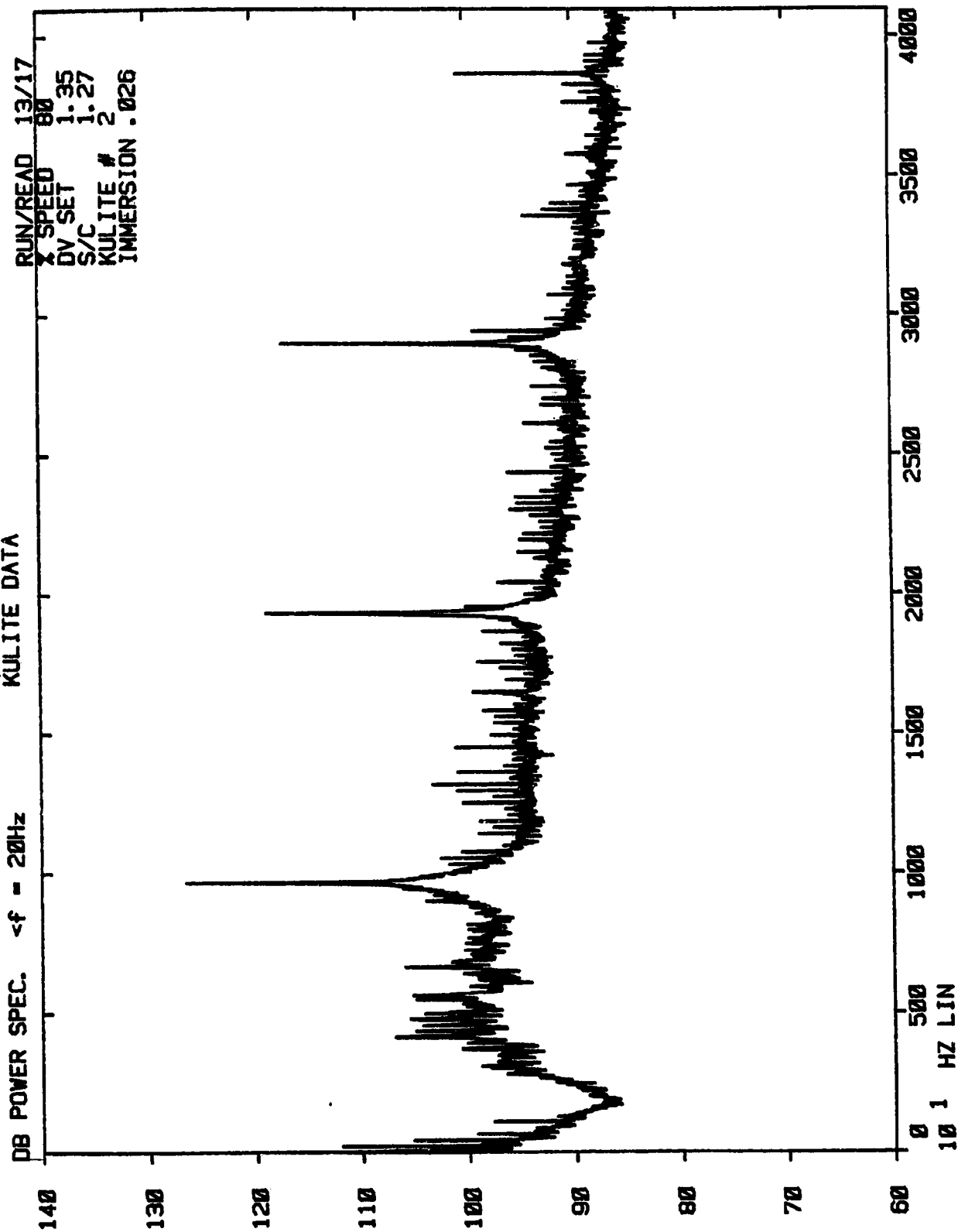


NASA V/B STUDY
KULITE DATA

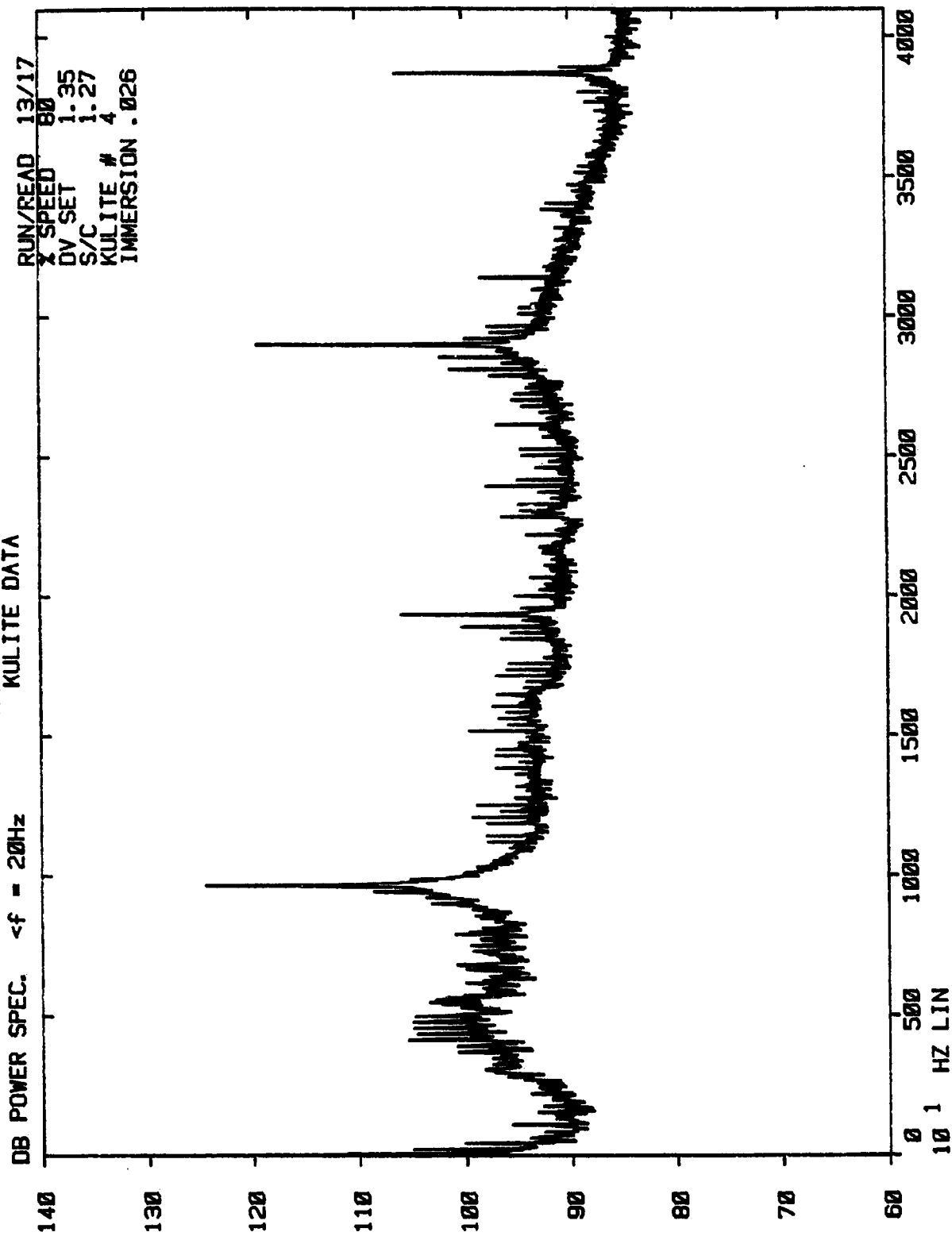
DB POWER SPEC. $< f = 20\text{Hz}$



NASA V/B STUDY
KULITE DATA

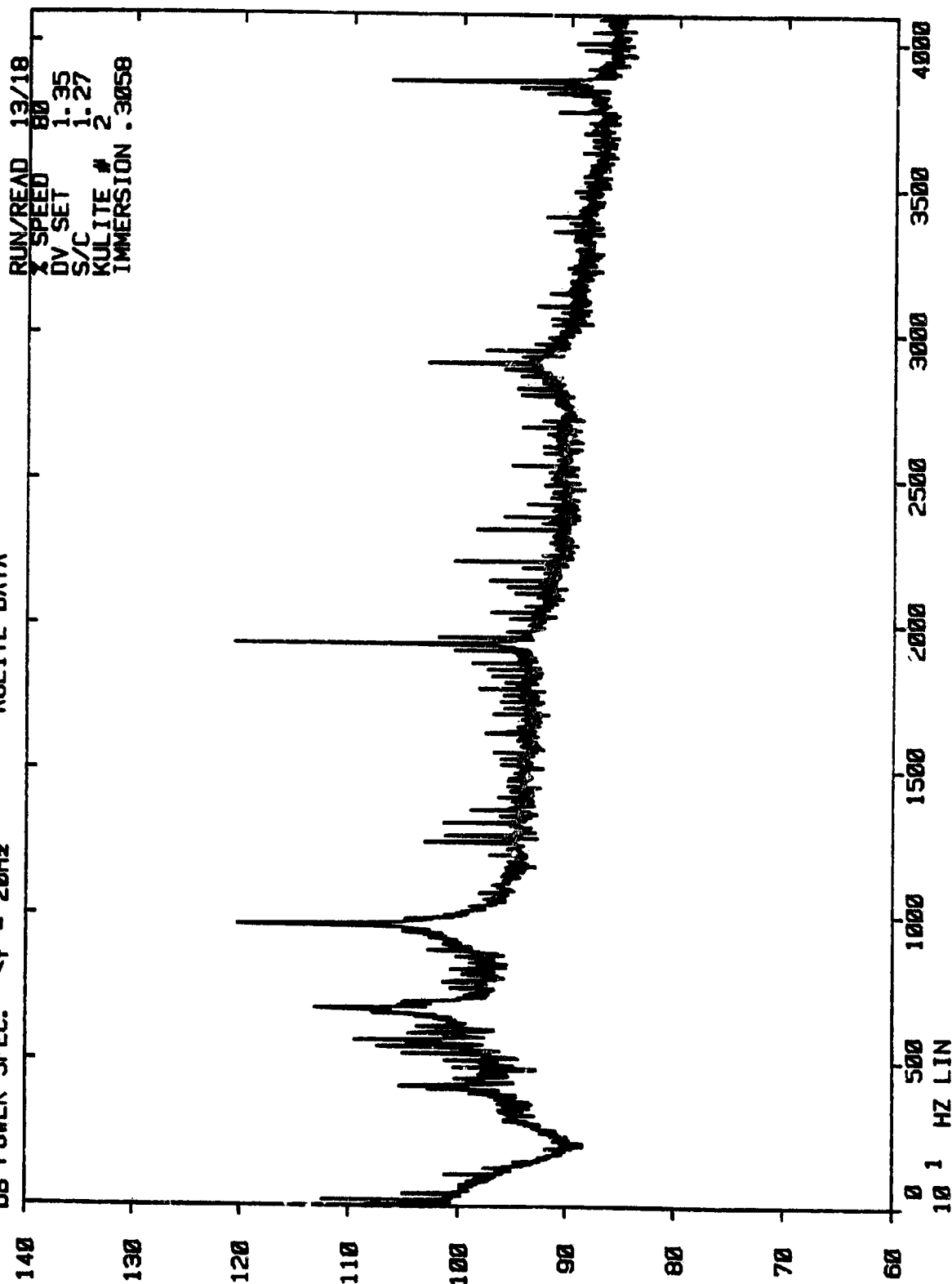


NASA V/B STUDY
KULITE DATA



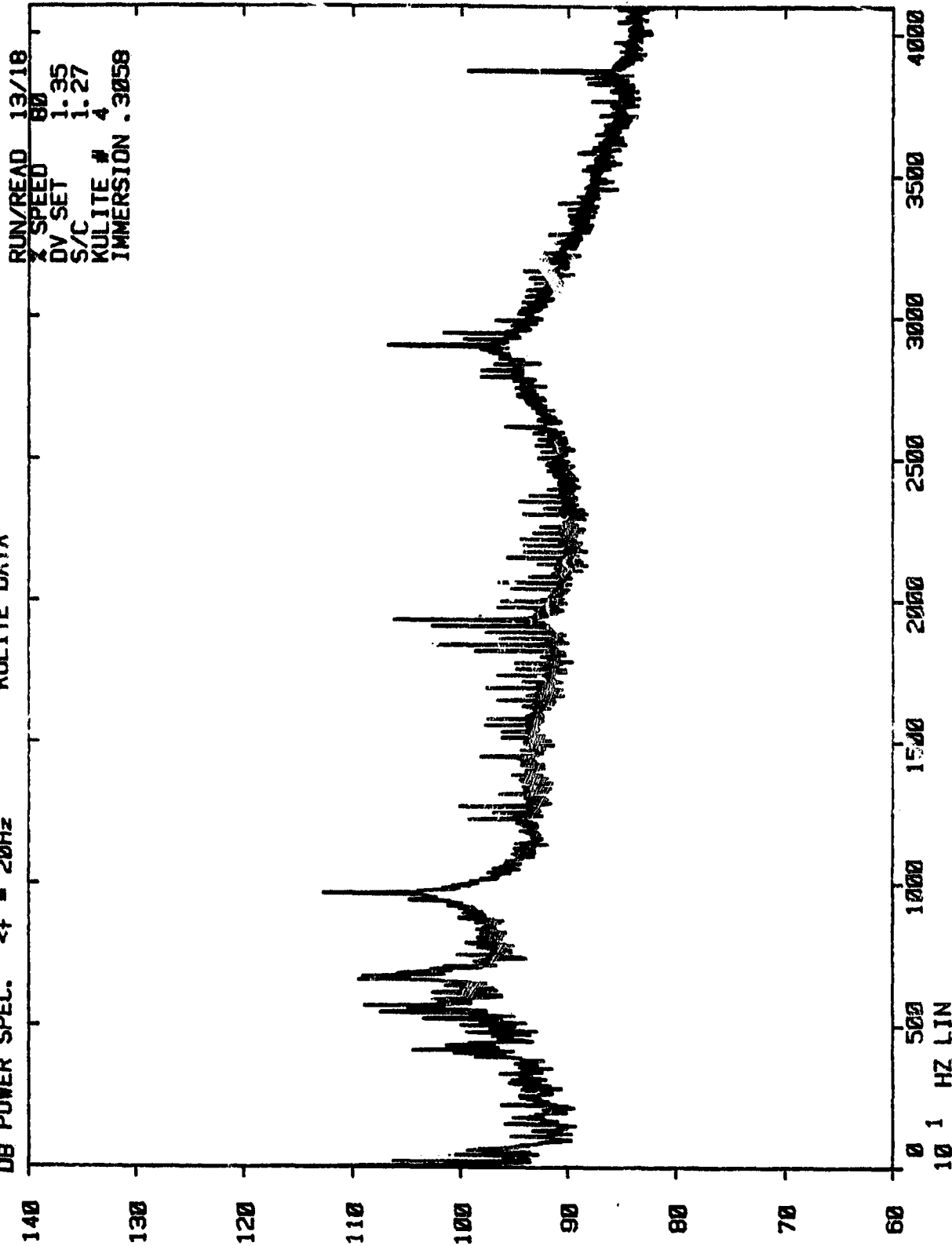
NASA V/B STUDY KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$

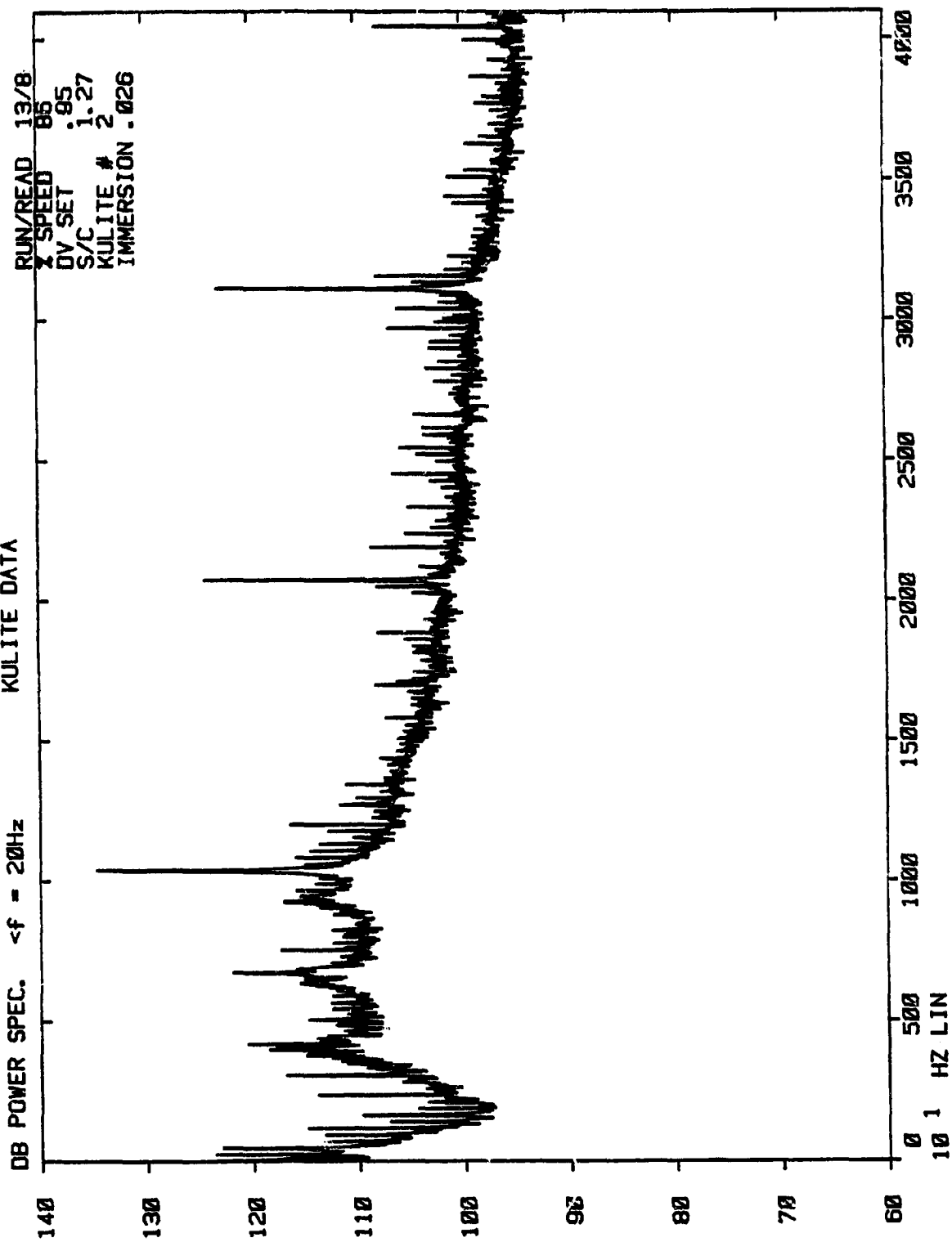


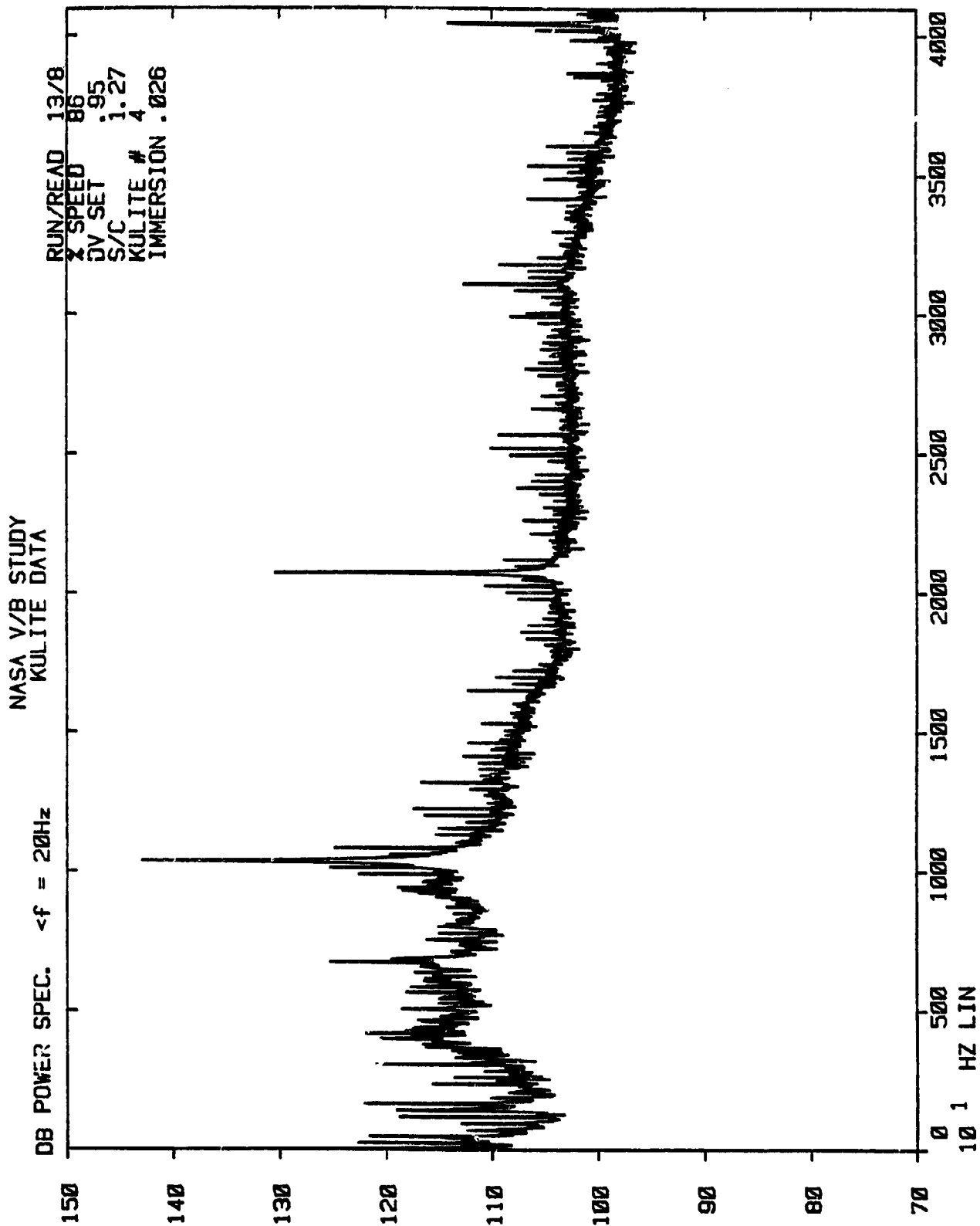
NASA V/B STUDY
KULITE DATA

DB POWER SPEC. $\langle f = 20\text{Hz} \rangle$



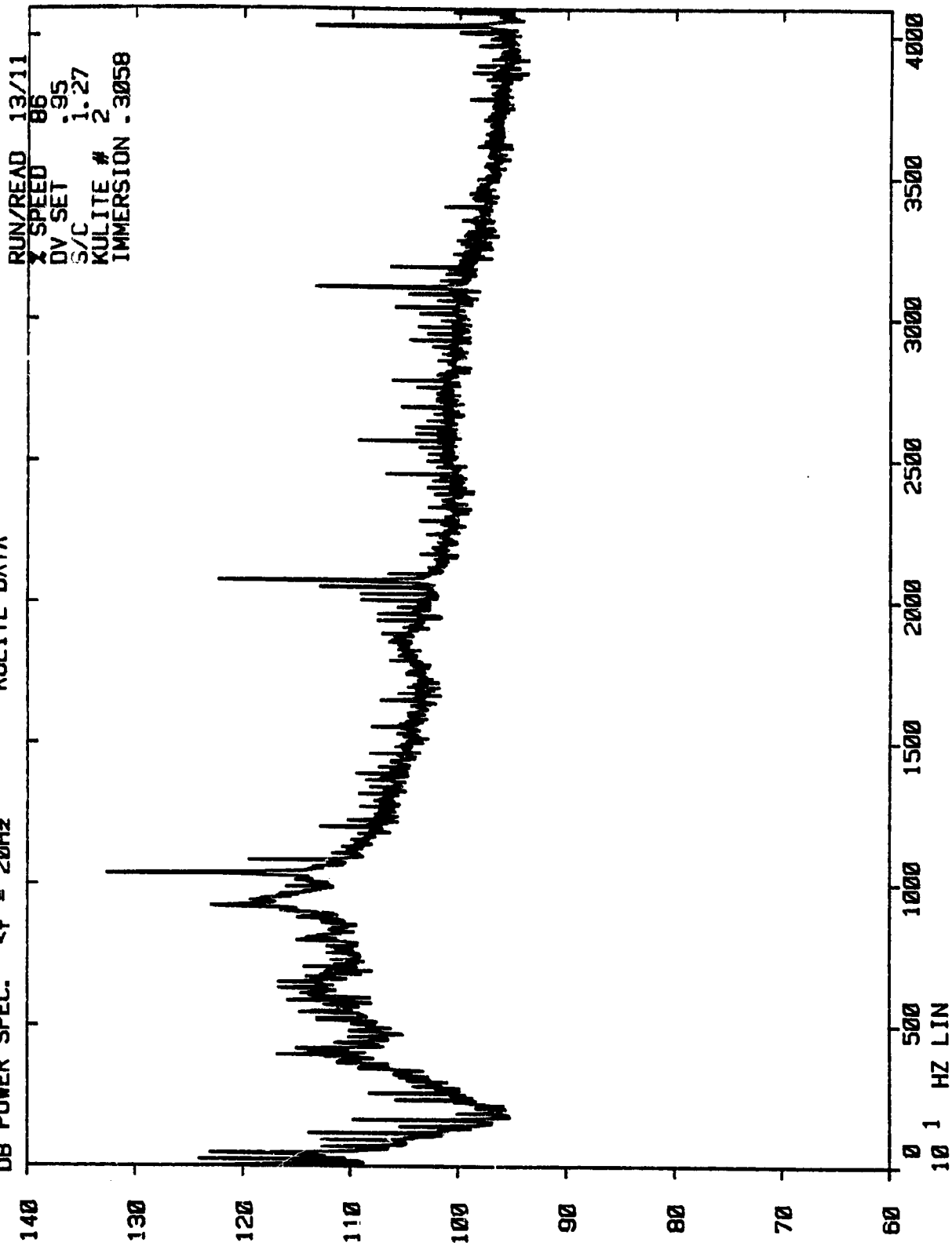
NASA V/B STUDY KULITE DATA





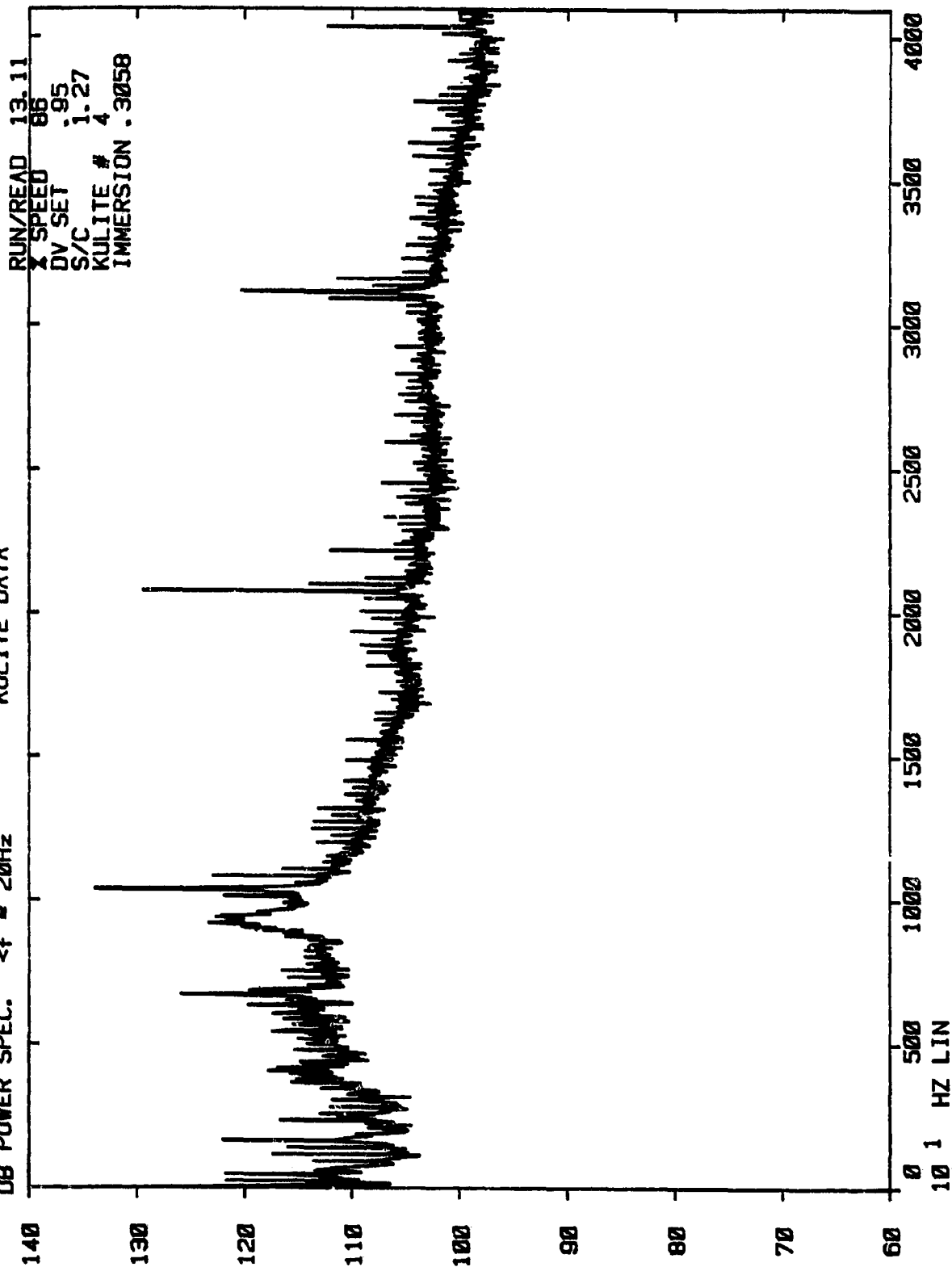
NASA V/B STUDY KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$



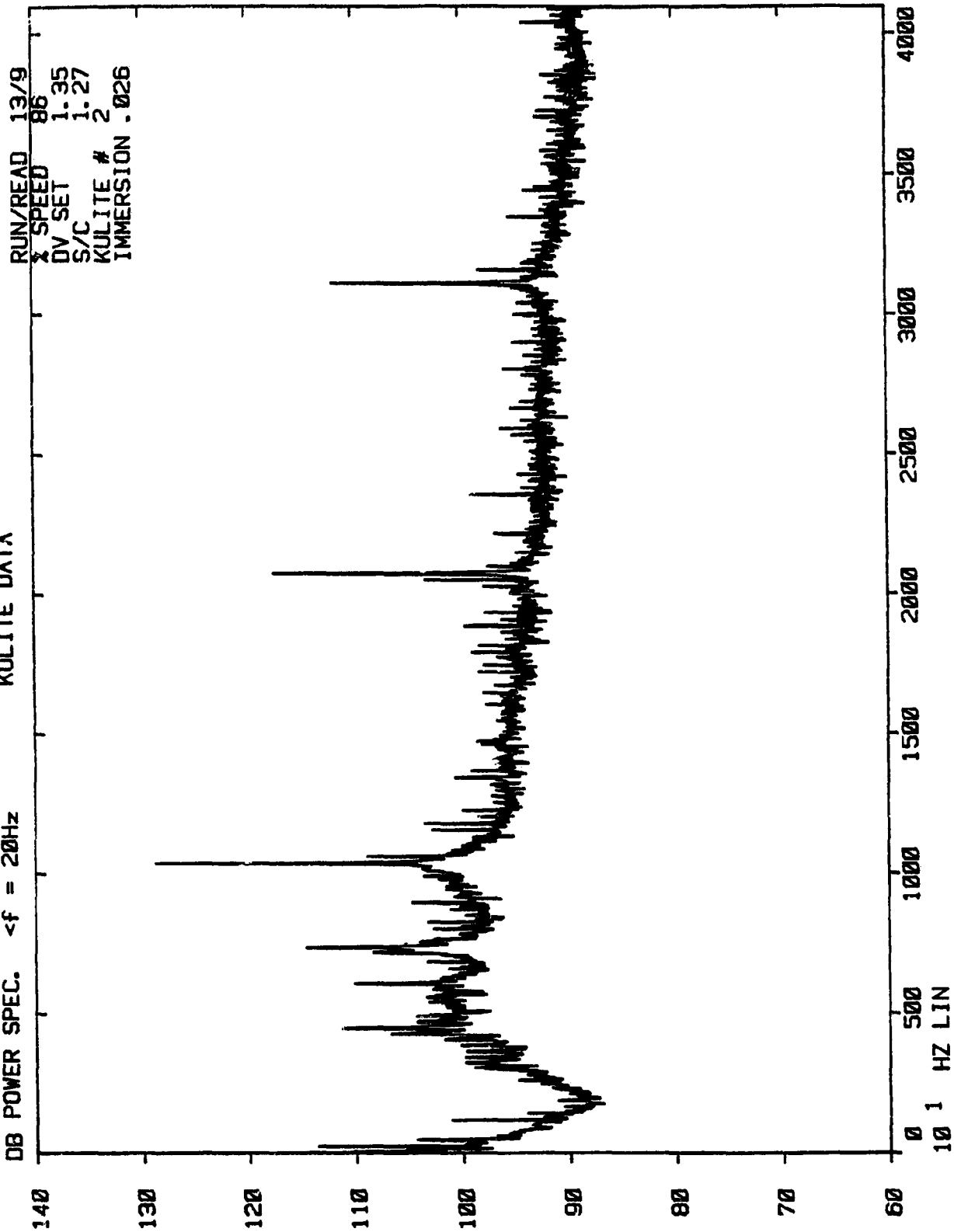
NASA V/B STUDY KULITE DATA

DB POWER SPEC. $<f = 20\text{Hz}$



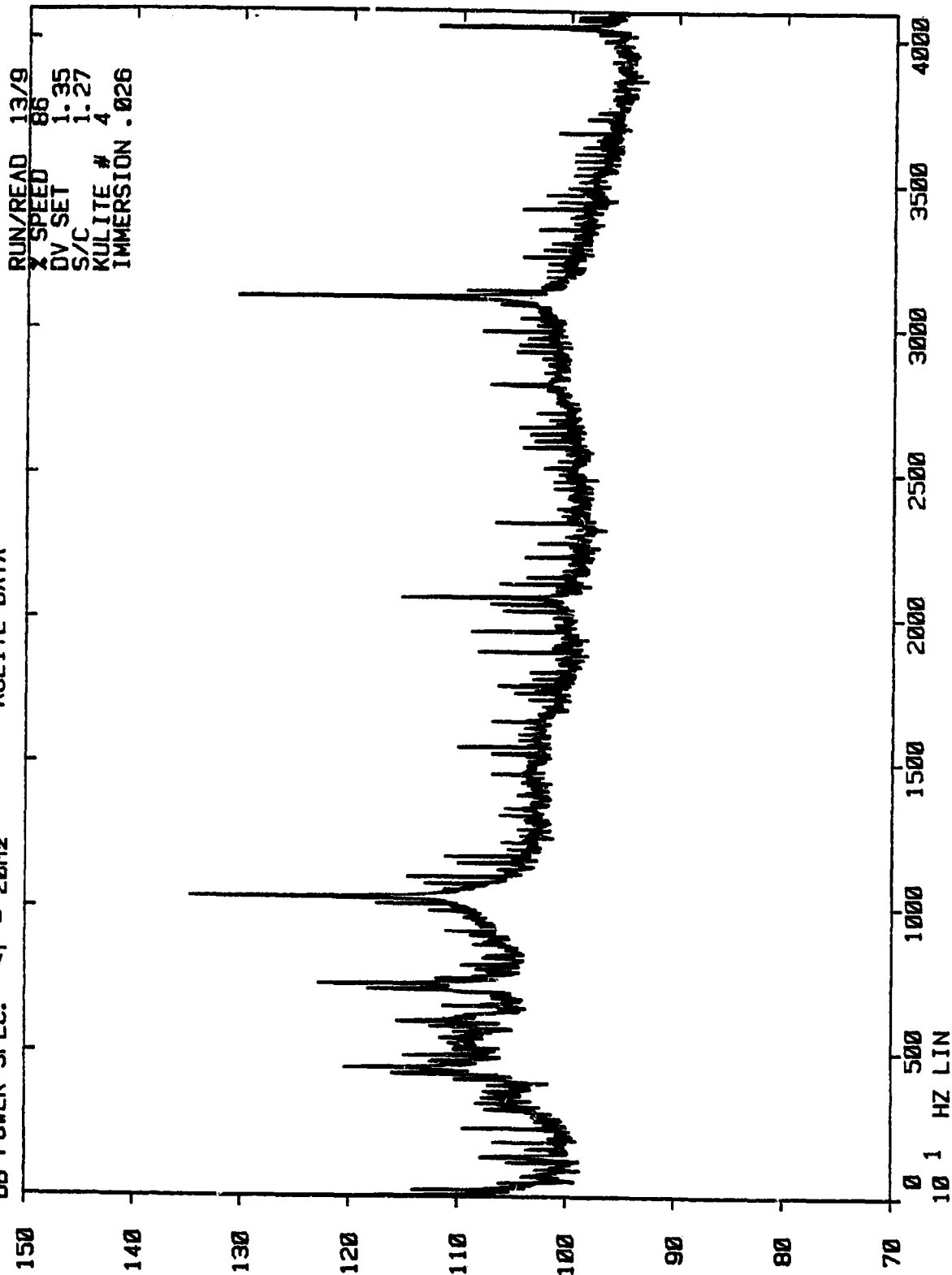
NASA V/B STUDY
KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$



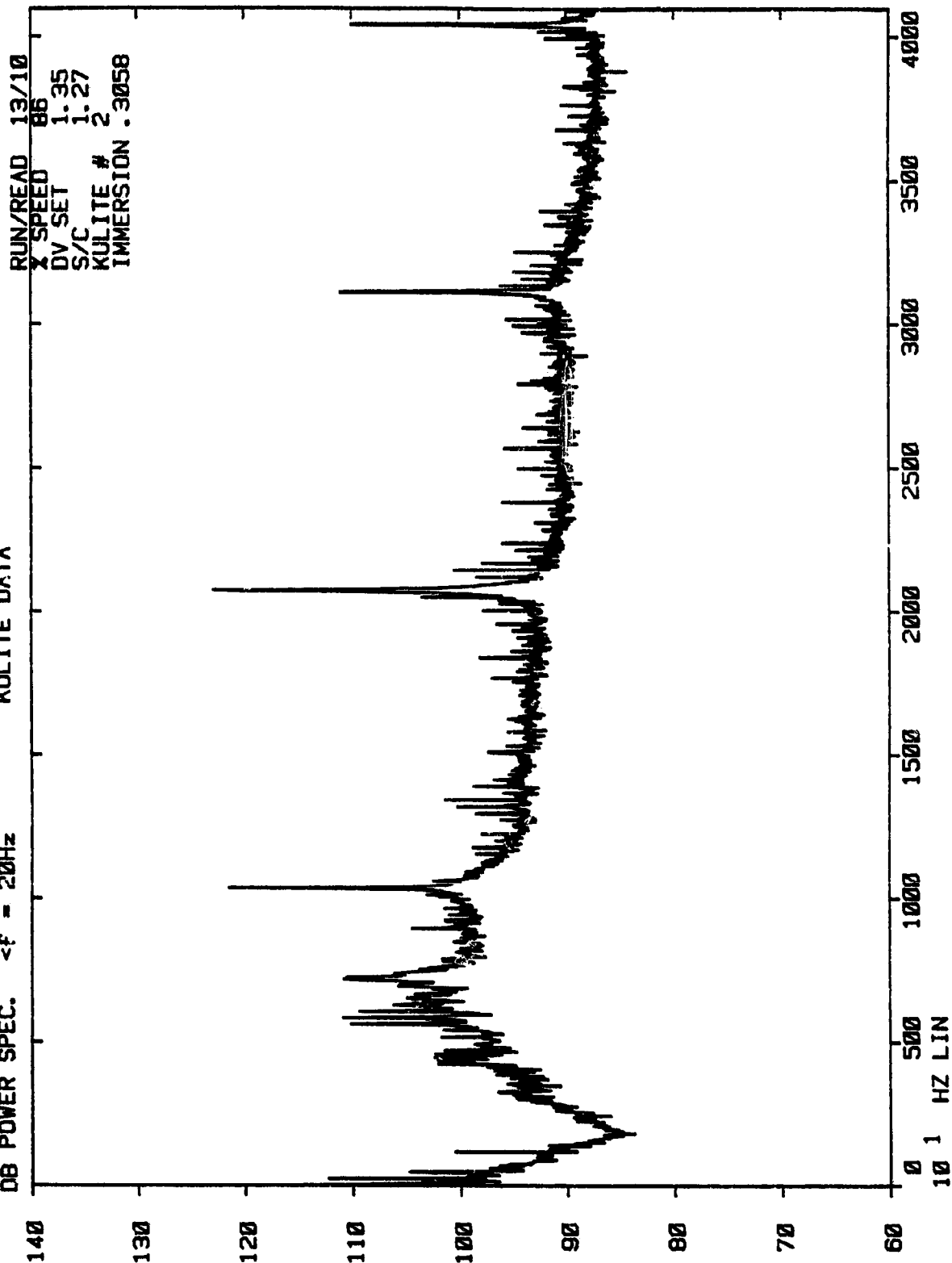
NASA V/B STUDY KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$



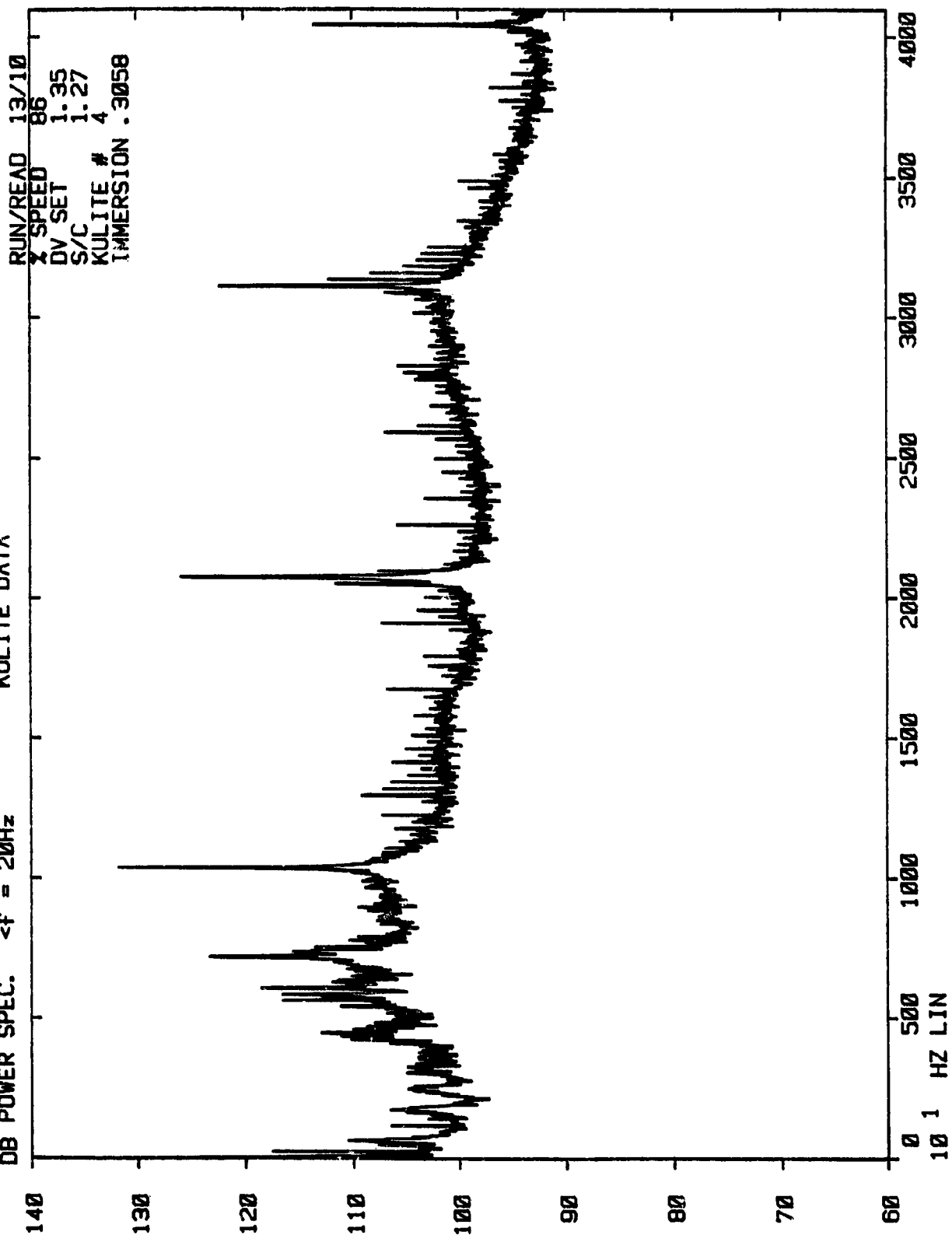
NASA V/B STUDY KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$



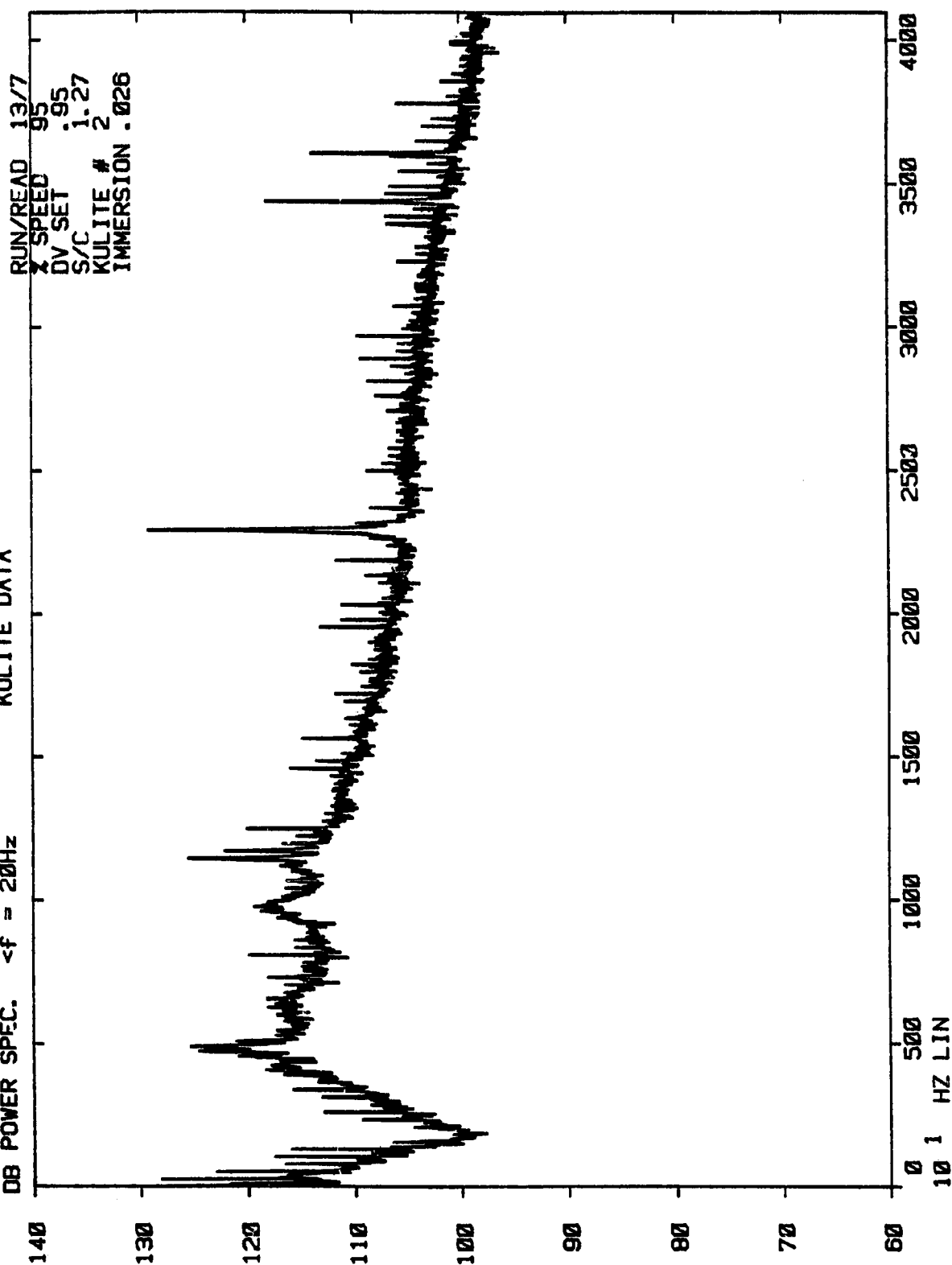
NASA V/B STUDY KULITE DATA

DB POWER SPEC. <f = 20Hz



NASA V/B STUDY
KULITE DATA

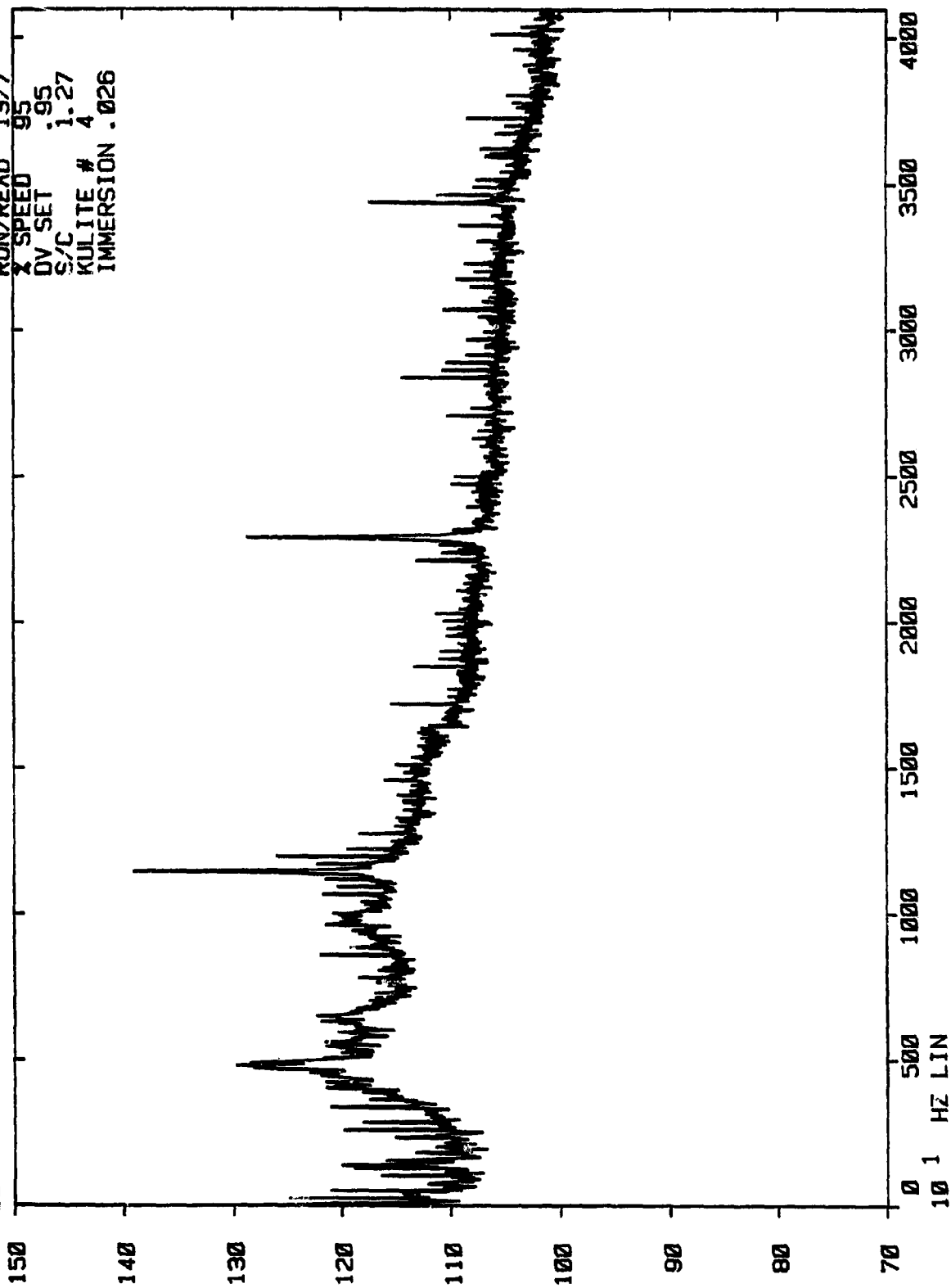
DB POWER SPEC. $\Delta f = 20\text{Hz}$



NASA V/B STUDY KULITE DATA

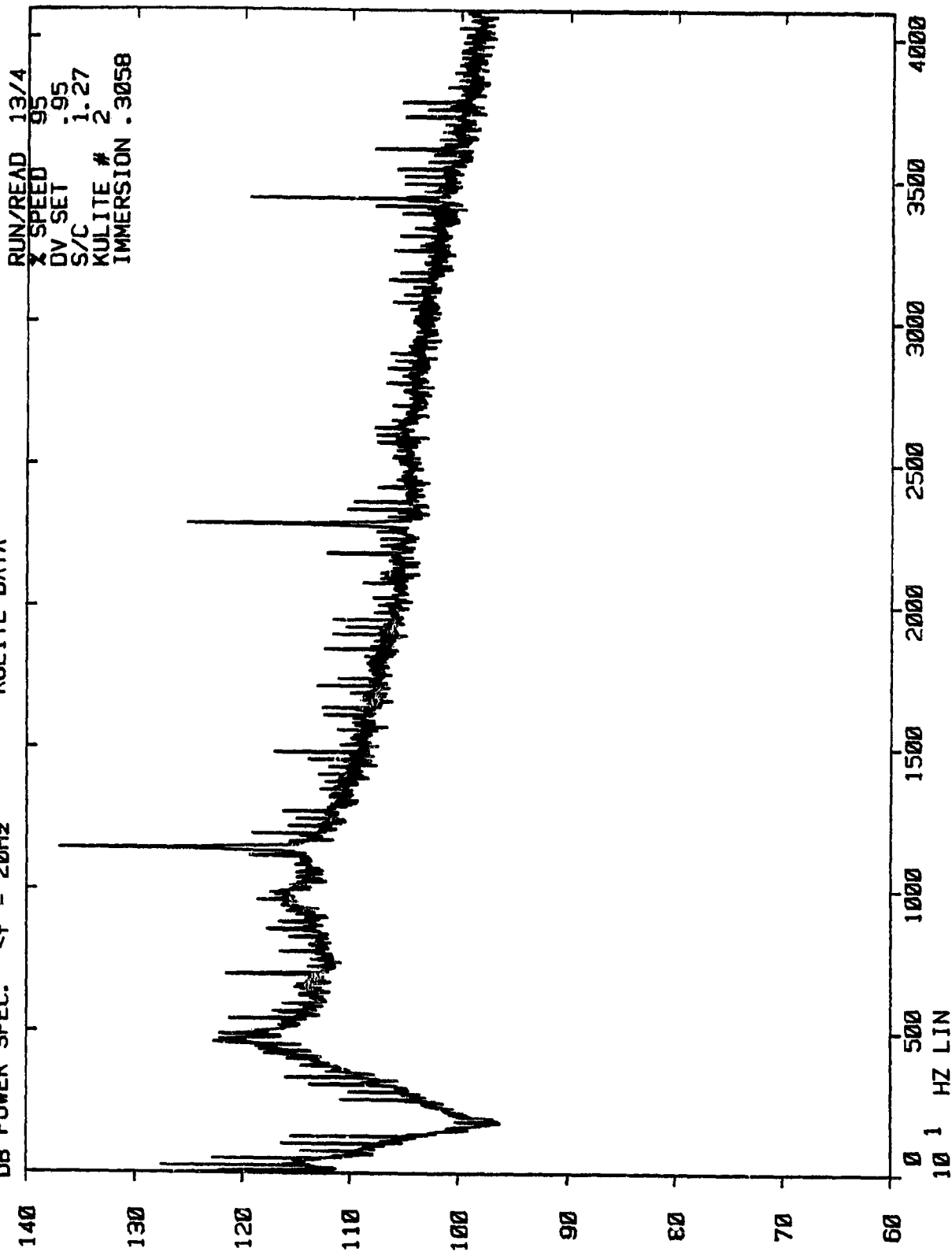
DB POWER SPEC. $\Delta f = 20\text{Hz}$

RUN/READ 13/7
X SPEED 95
DV SET .95
S/C 1.27
KULITE # 4
IMMERSION .026



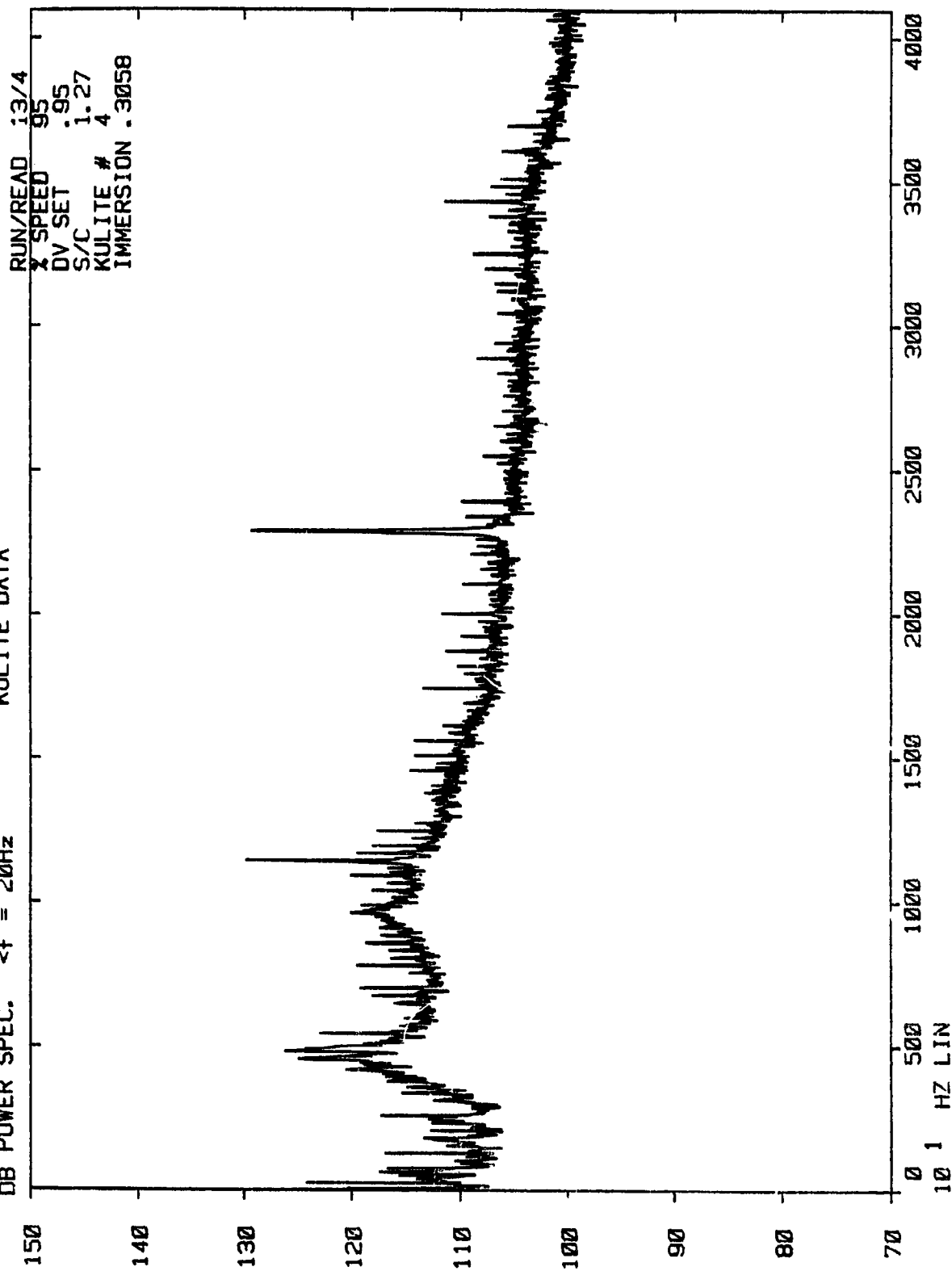
NASA V/B STUDY
KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$



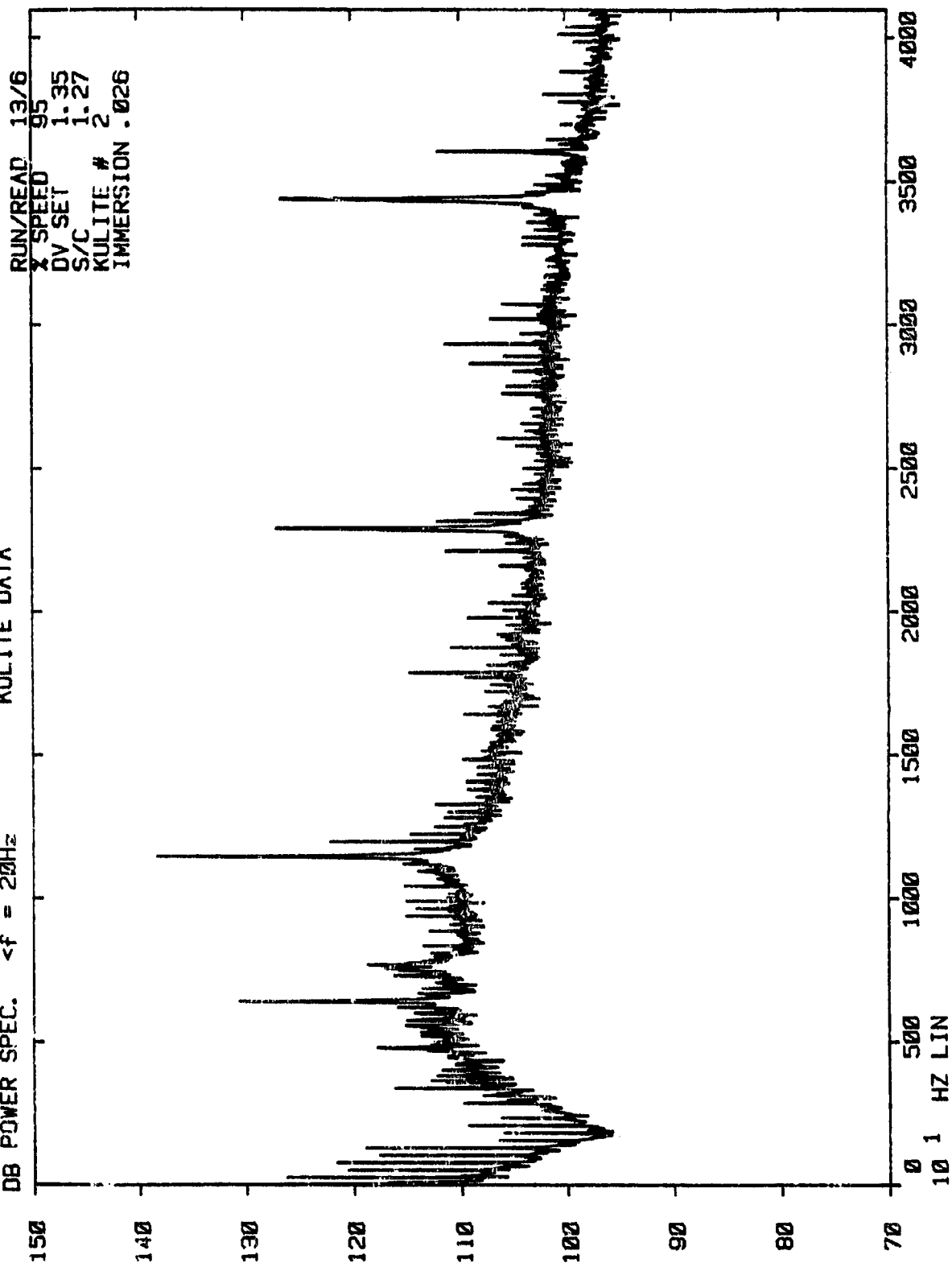
NASA V/B STUDY
KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$



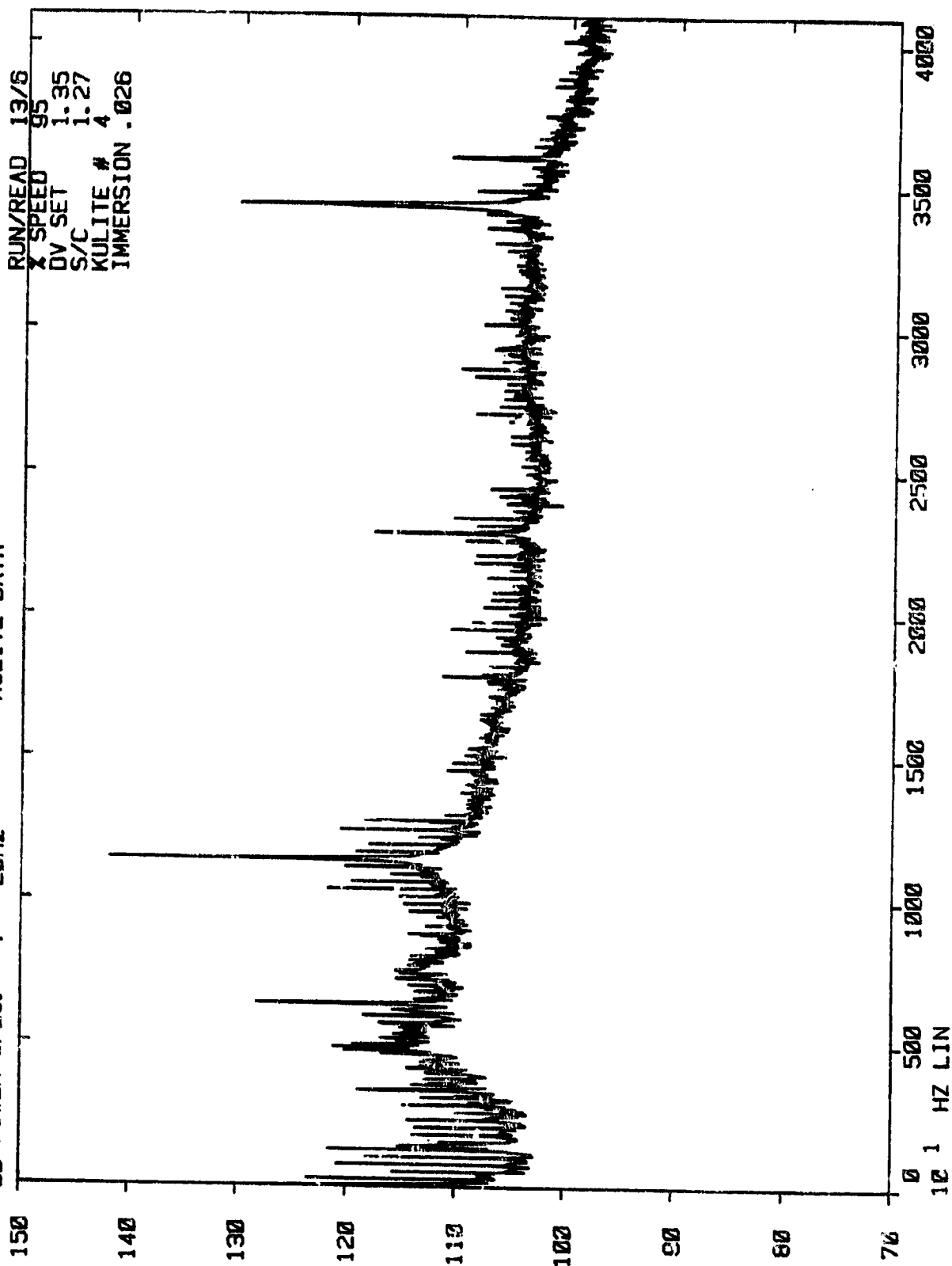
NASA V/B STUDY KULITE DATA

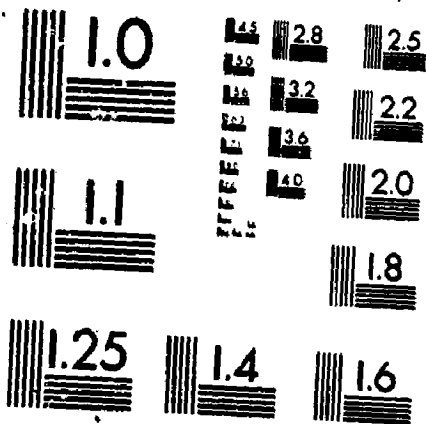
DB POWER SPEC. $\angle f = 20\text{Hz}$



NASA V/B STUDY
KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$

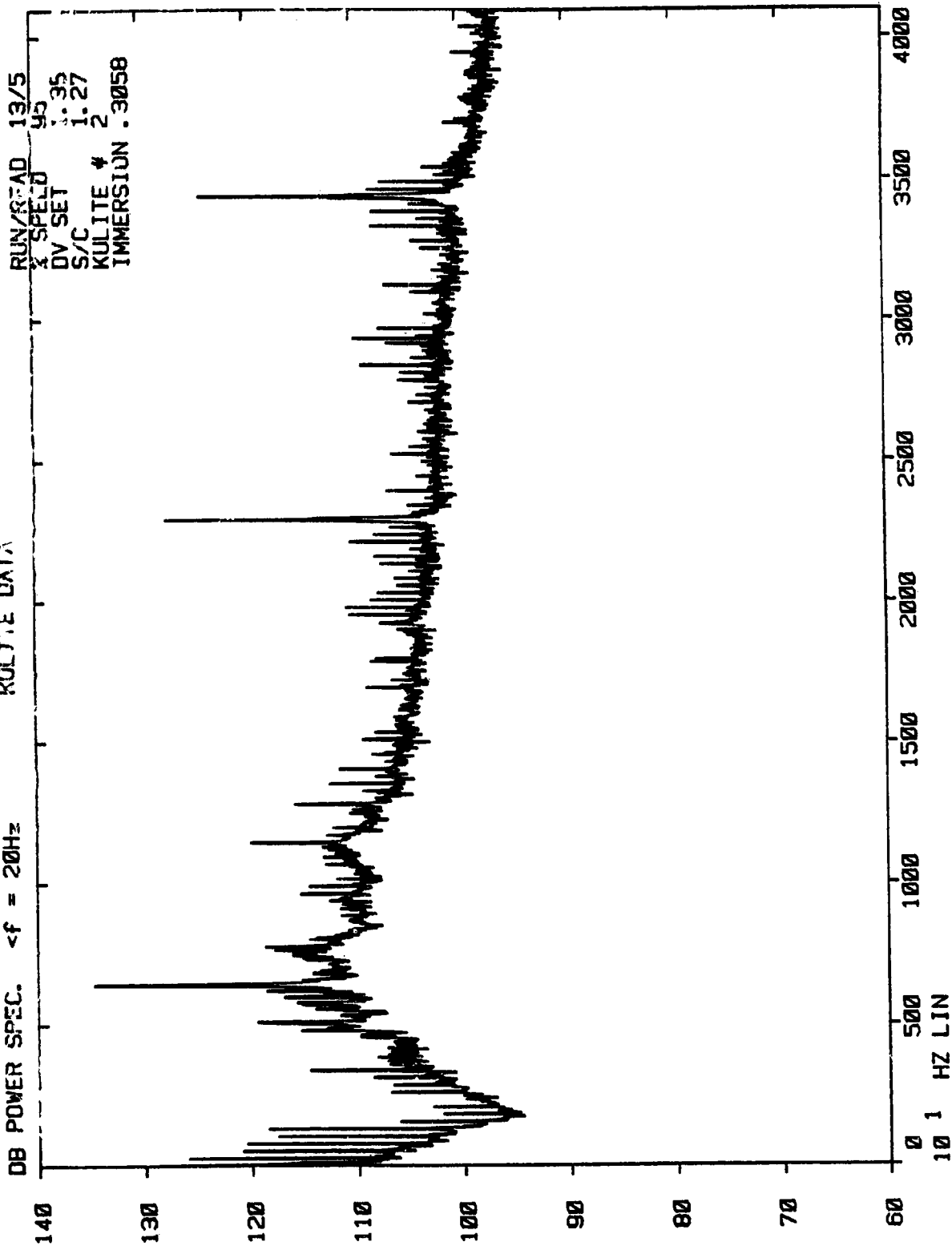




**MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS
STANDARD REFERENCE MATERIAL 1010a
(ANSI and ISO TEST CHART No. 2)**

NASA W/D STUDY KULITE DATA

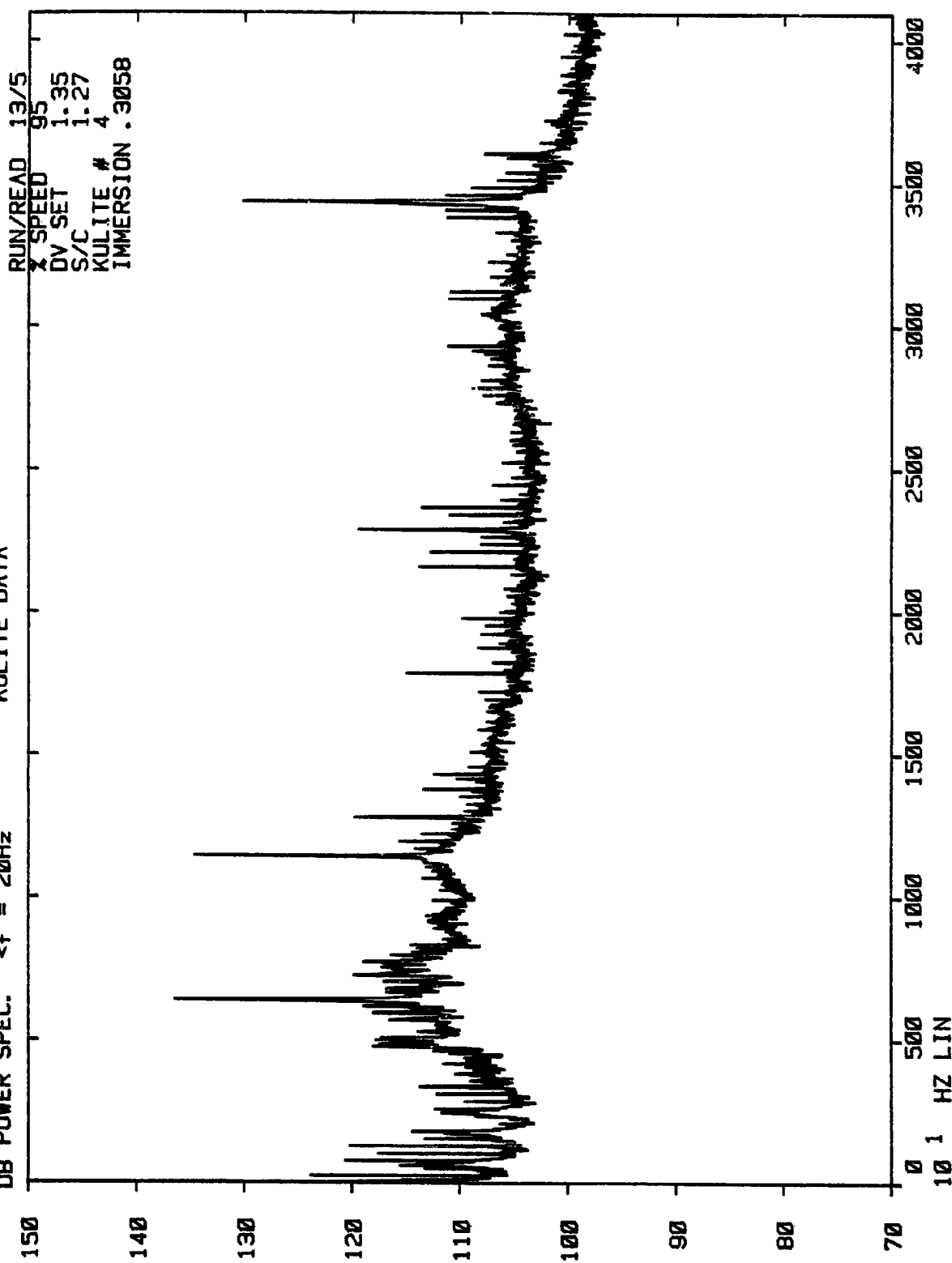
DB POWER SPEC. $\Delta f = 20\text{Hz}$



C-4

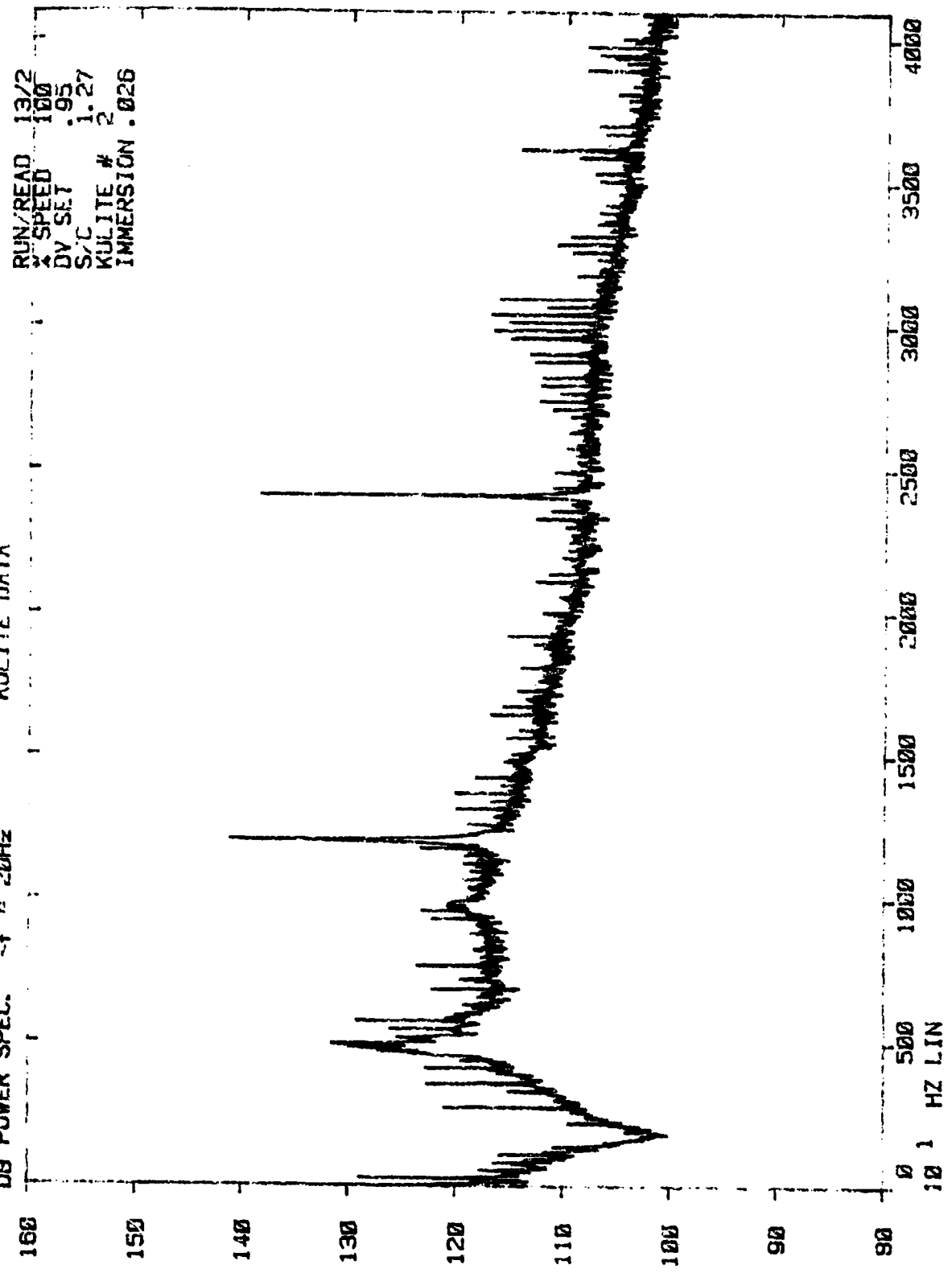
NASA V/B STUDY
KULITE DATA

DB POWER SPEC. $<f = 20\text{Hz}$



NASA V/B STUDY
KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$

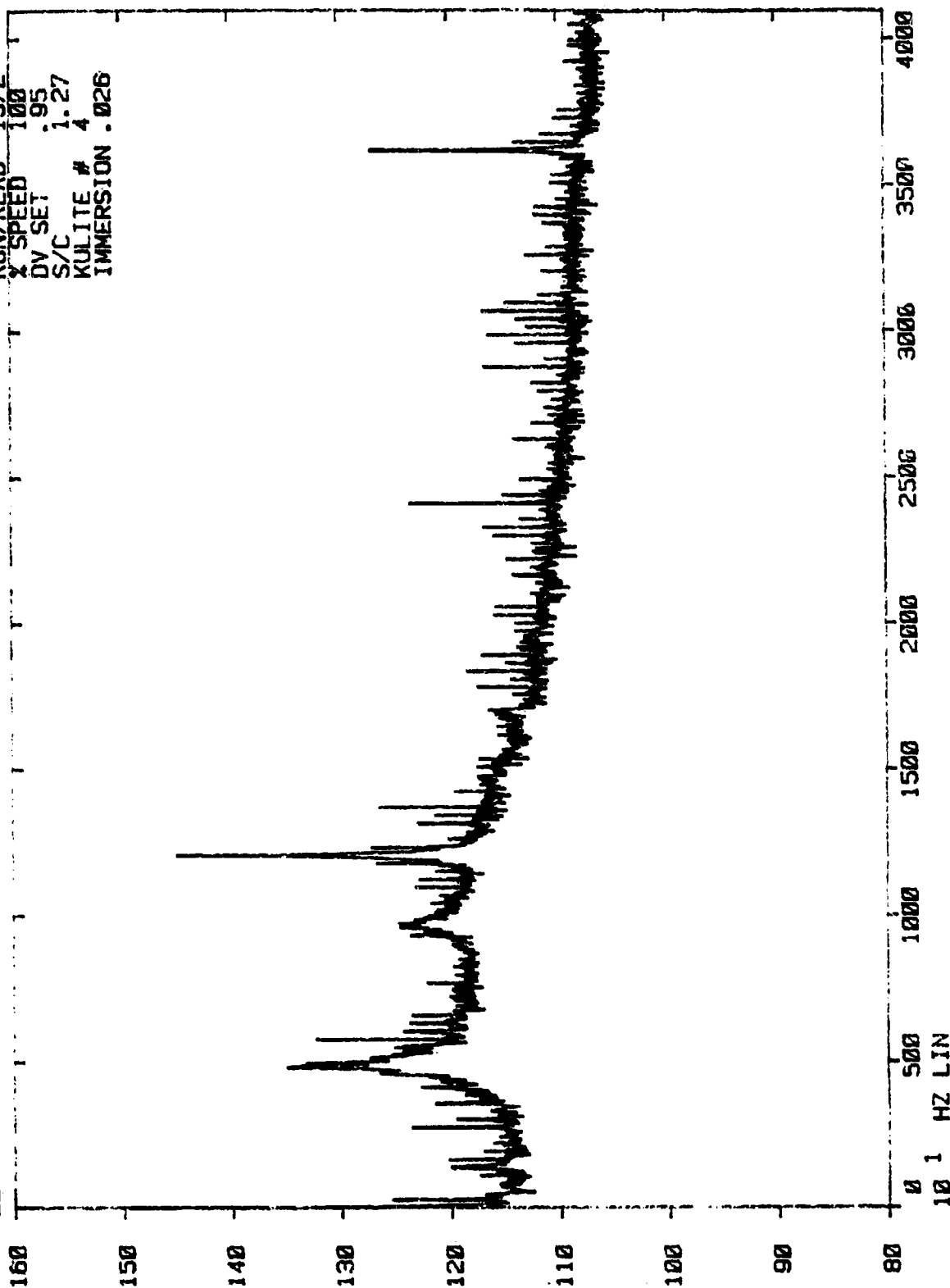


RUN/READ 13/2
SPEED 100
DV SET .95
S/C 1.27
KULITE # 2
IMMERSION .026

NASA V/B STUDY
KULITE DATA

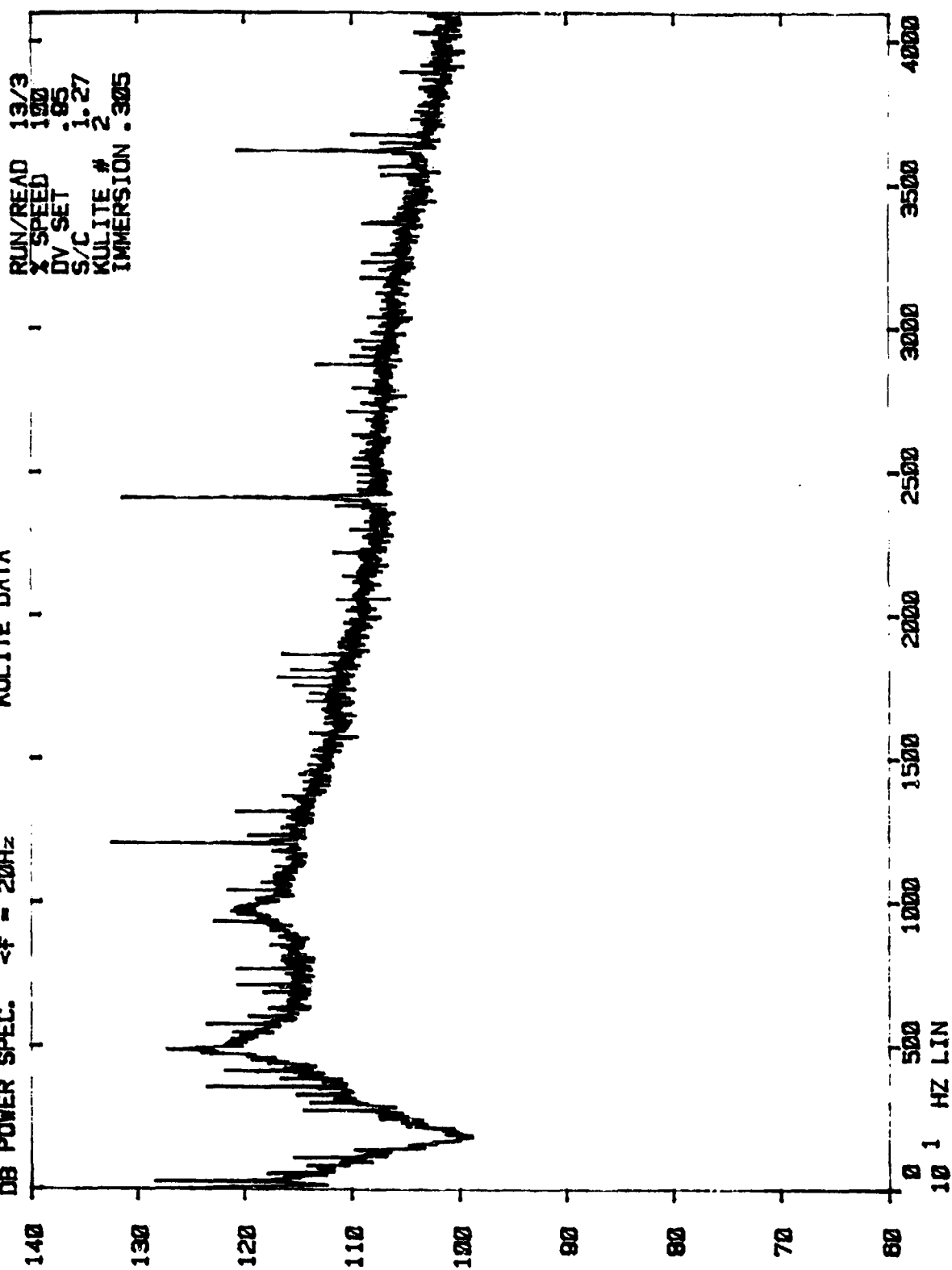
DB POWER SPEC. $<f = 20\text{Hz}$

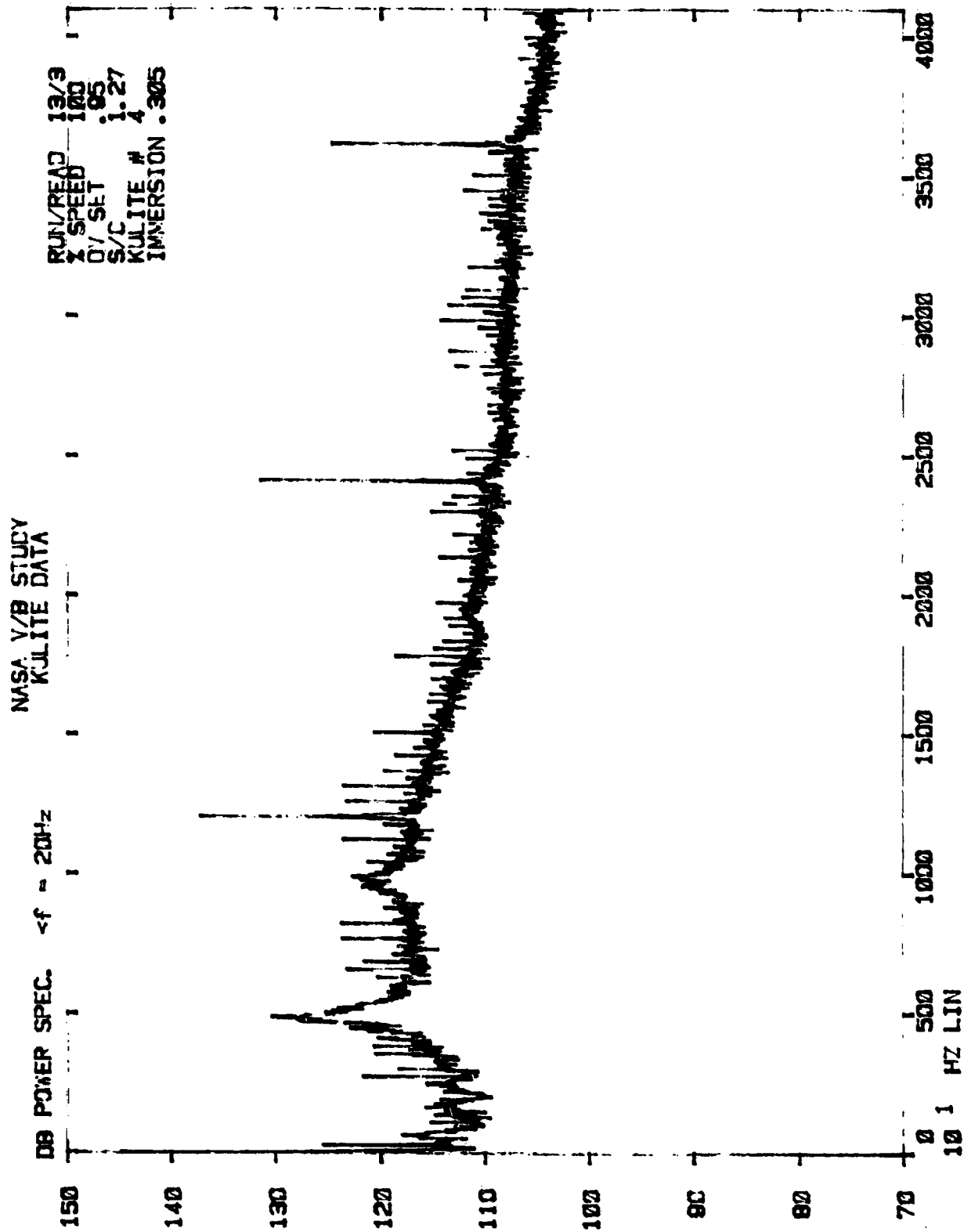
RUN/READ 13/2
X SPEED 100
DV SET .95
S/C 1.27
KULITE # 4
IMMERISION .026



NASA V/B STUDY
KULITE DATA

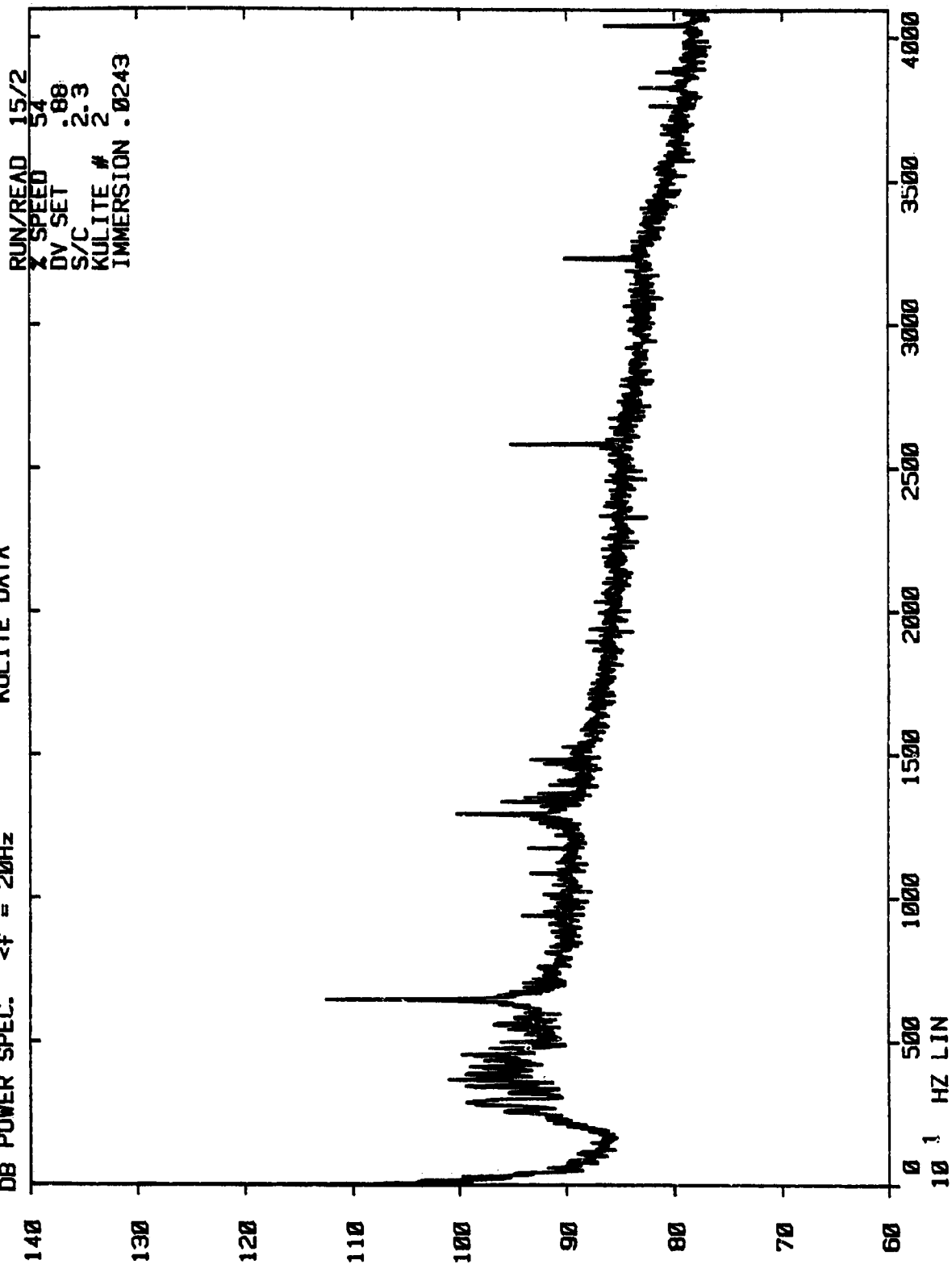
DB POWER SPEC. $\Delta f = 20\text{Hz}$





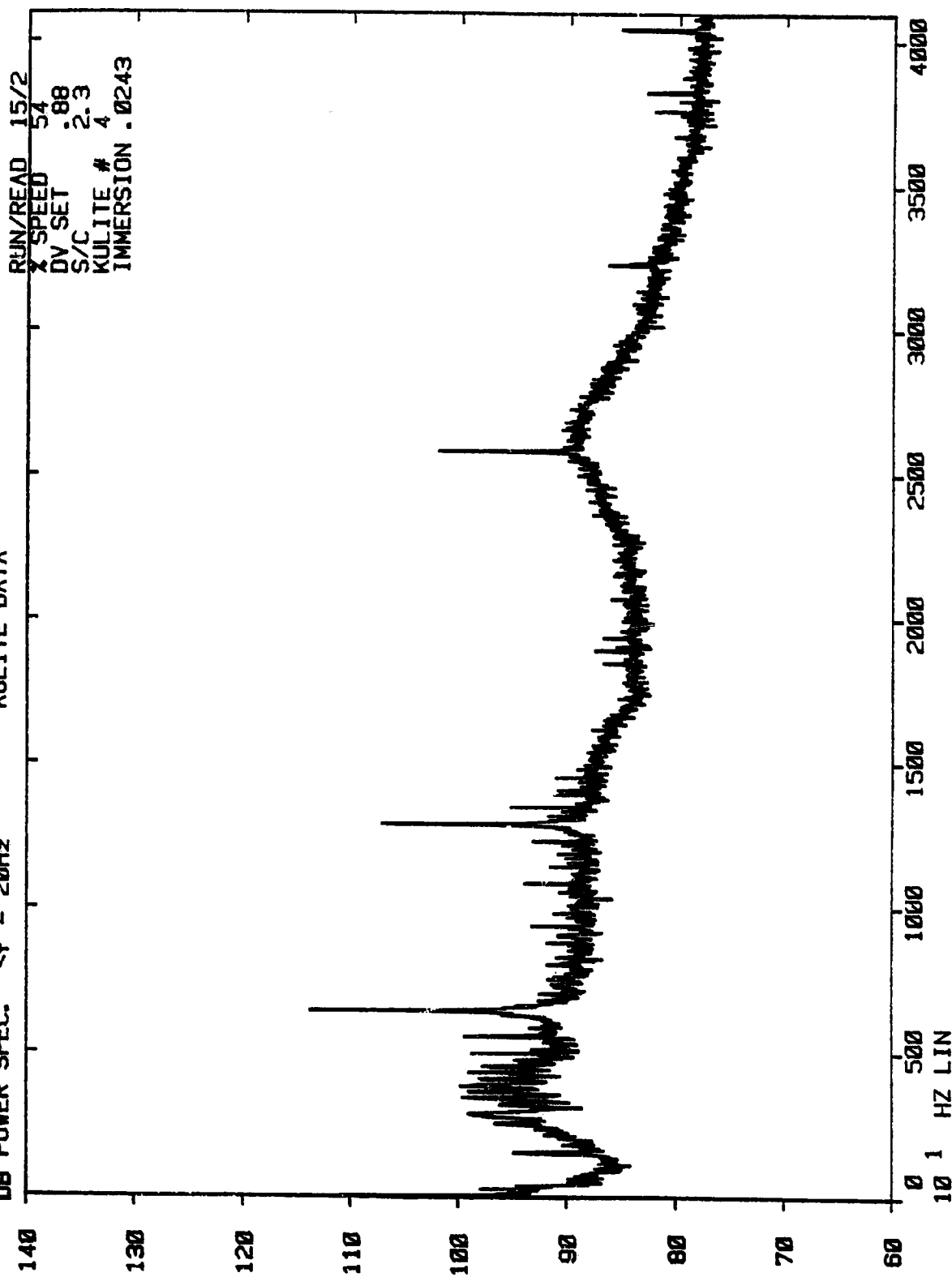
NASA V/B STUDY KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$



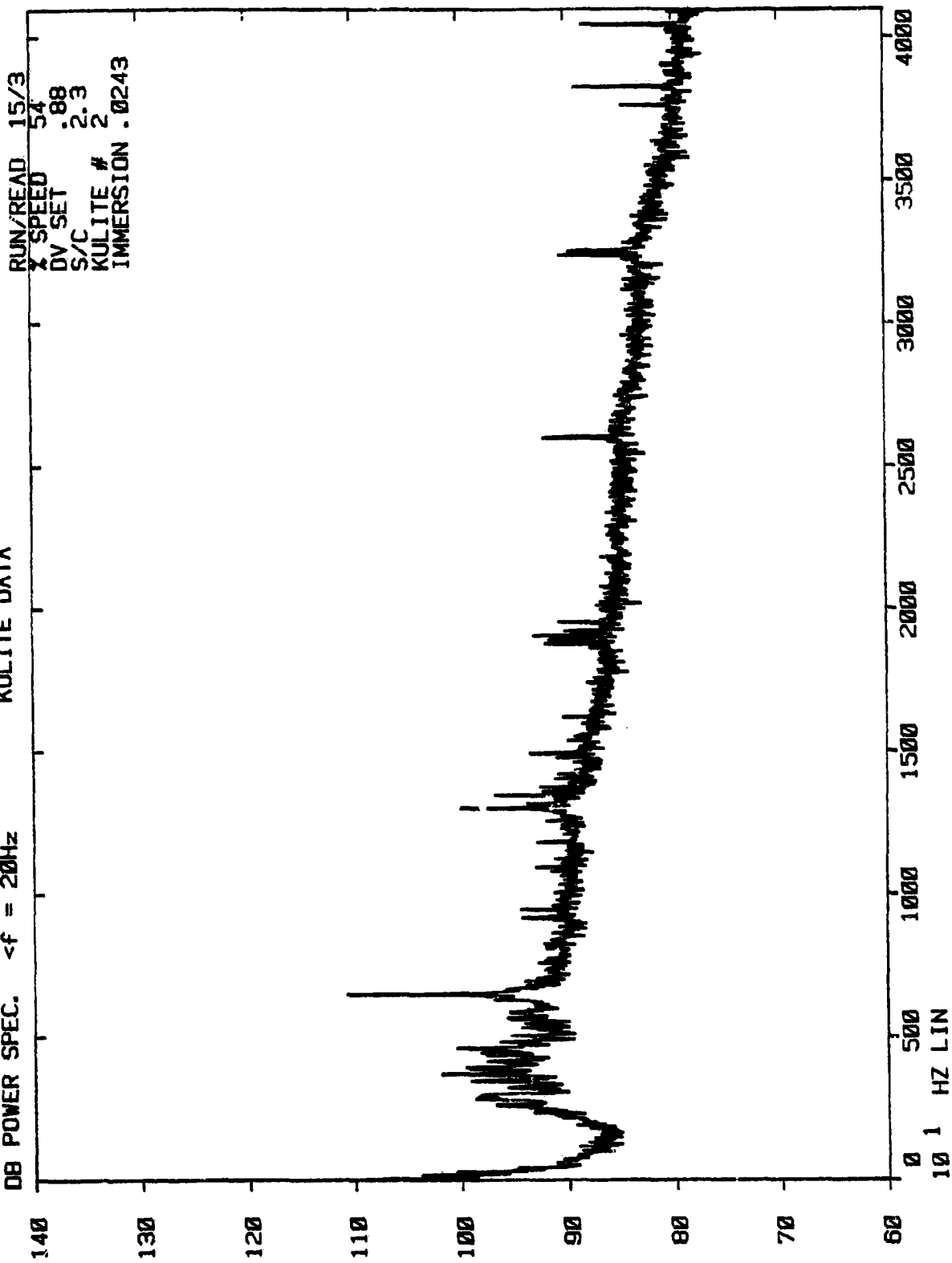
NASA V/B STUDY
KULITE DATA

DB POWER SPEC. $\leq f = 20\text{Hz}$



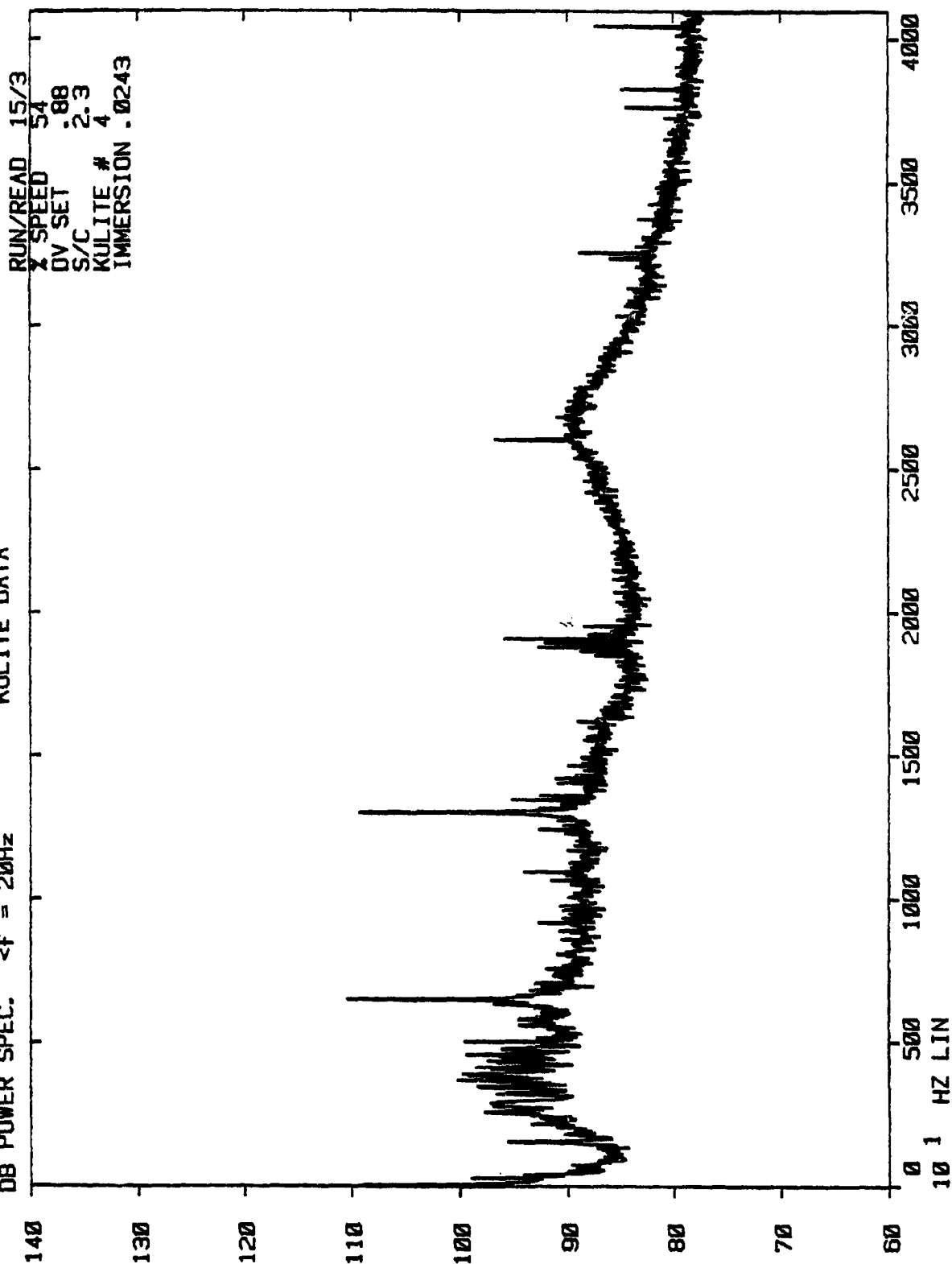
NASA V/B STUDY KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$



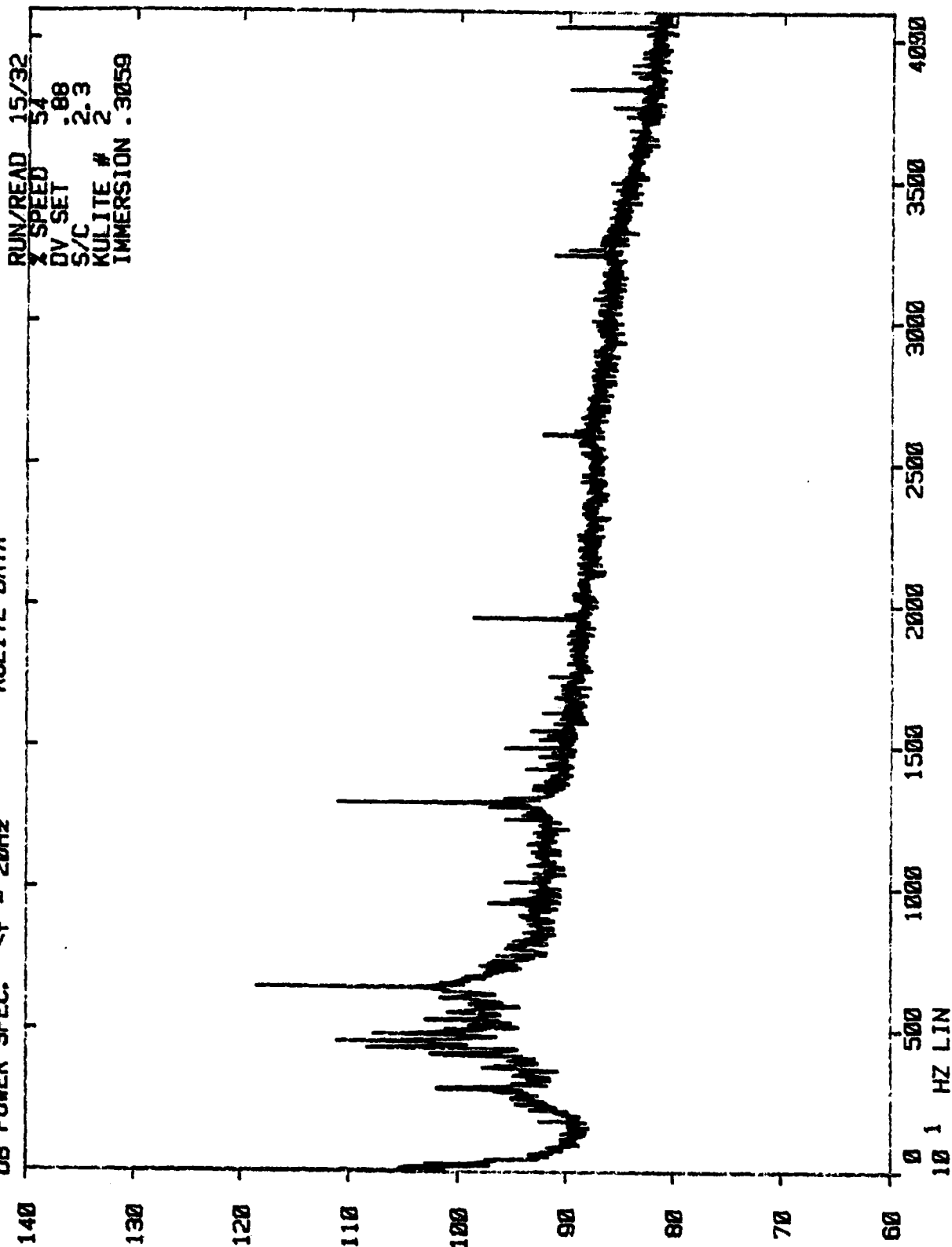
NASA V/B STUDY KULITE DATA

DB POWER SPEC. $< f = 20\text{Hz}$



NASA V/B STUDY KULITE DATA

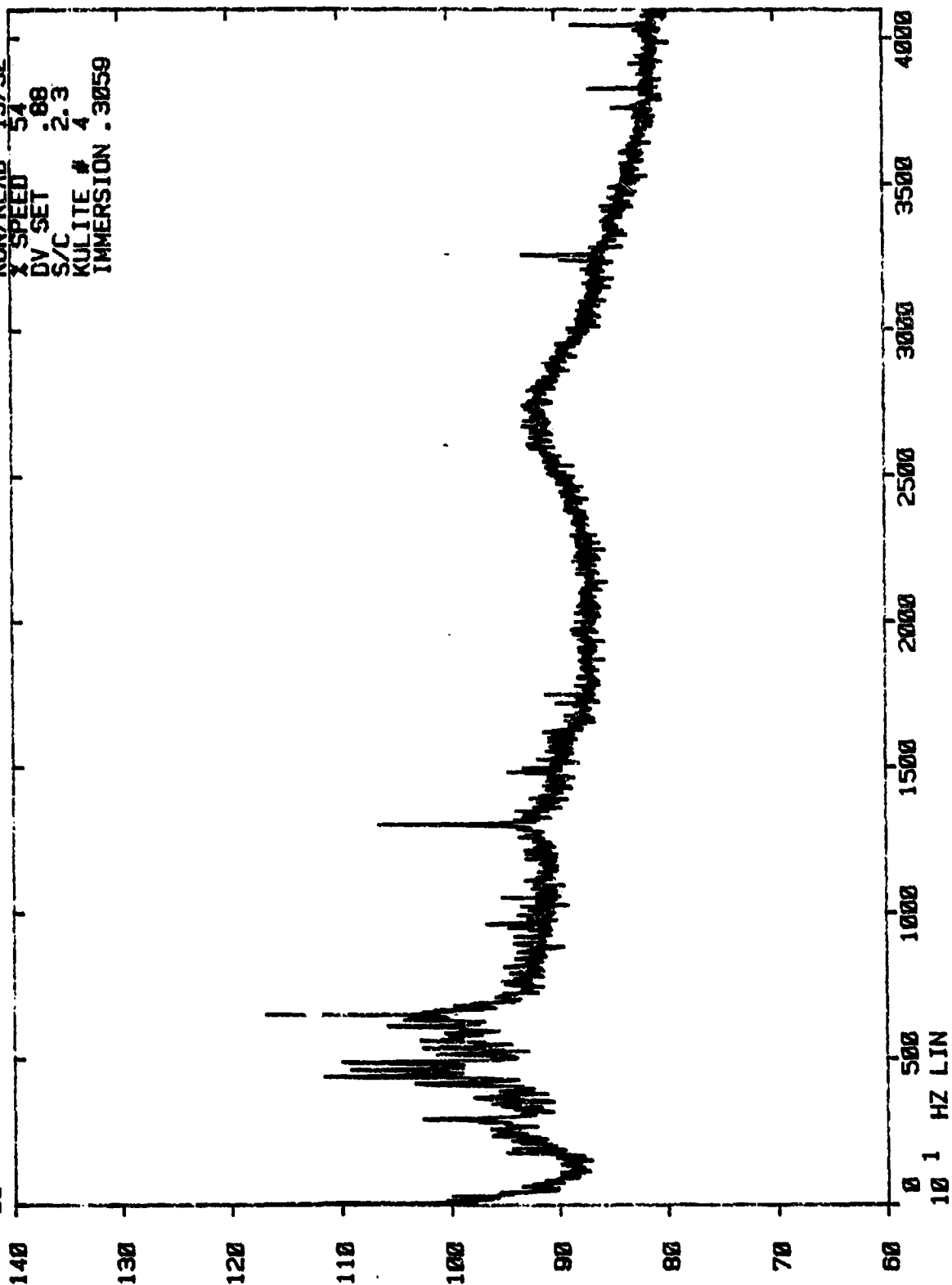
DB POWER SPEC. $\Delta f = 20\text{Hz}$



NASA V/B STUDY KULITE DATA

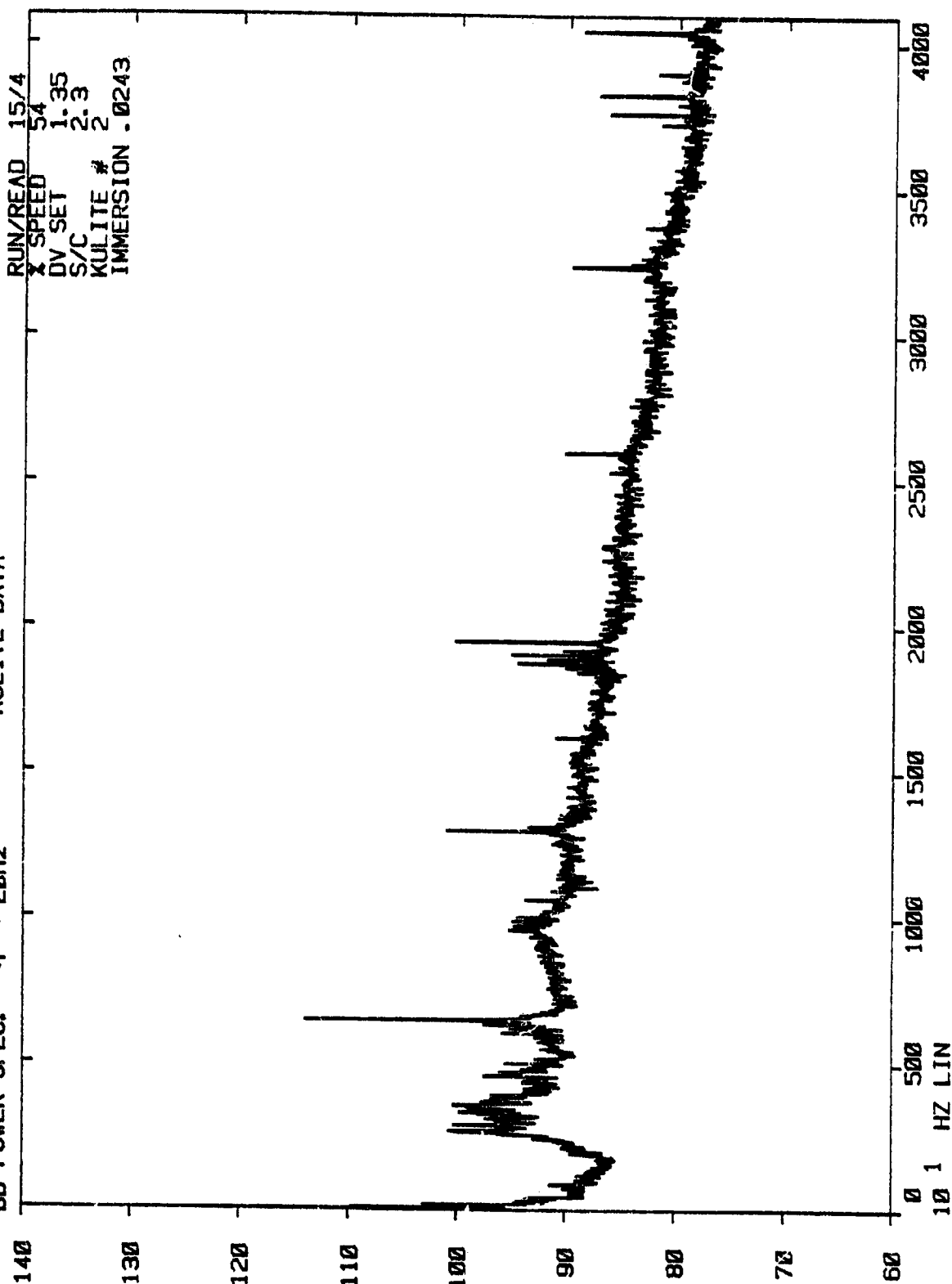
DB POWER SPEC. $<f = 20\text{Hz}$

RUN/READ 15/32
X SPEED 54
DV SET .88
S/C 2.3
KULITE # 4
IMMERSION .3059



NASA V/B STUDY
KULITE DATA

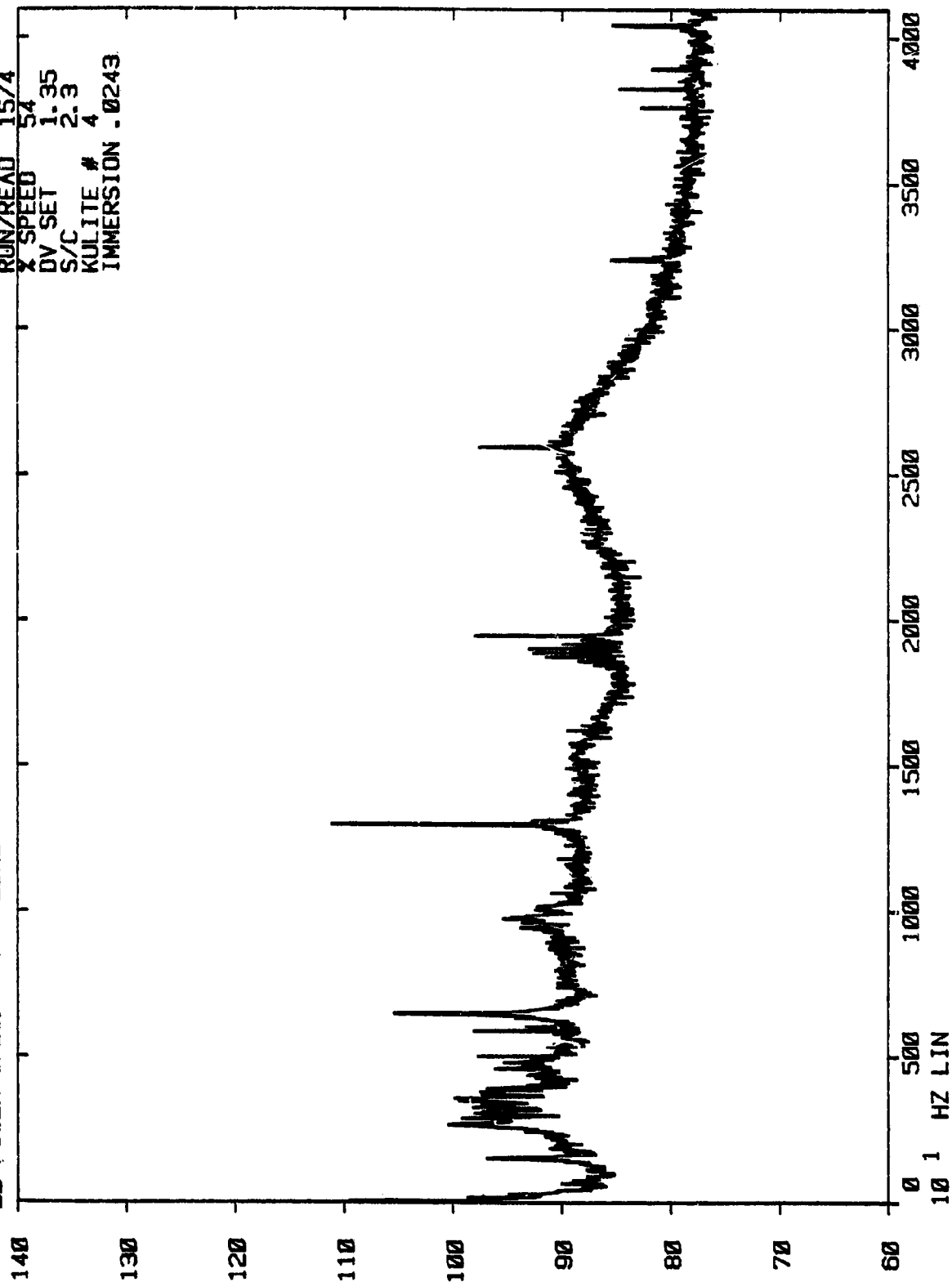
DB POWER SPEC. $\Delta f = 20\text{Hz}$



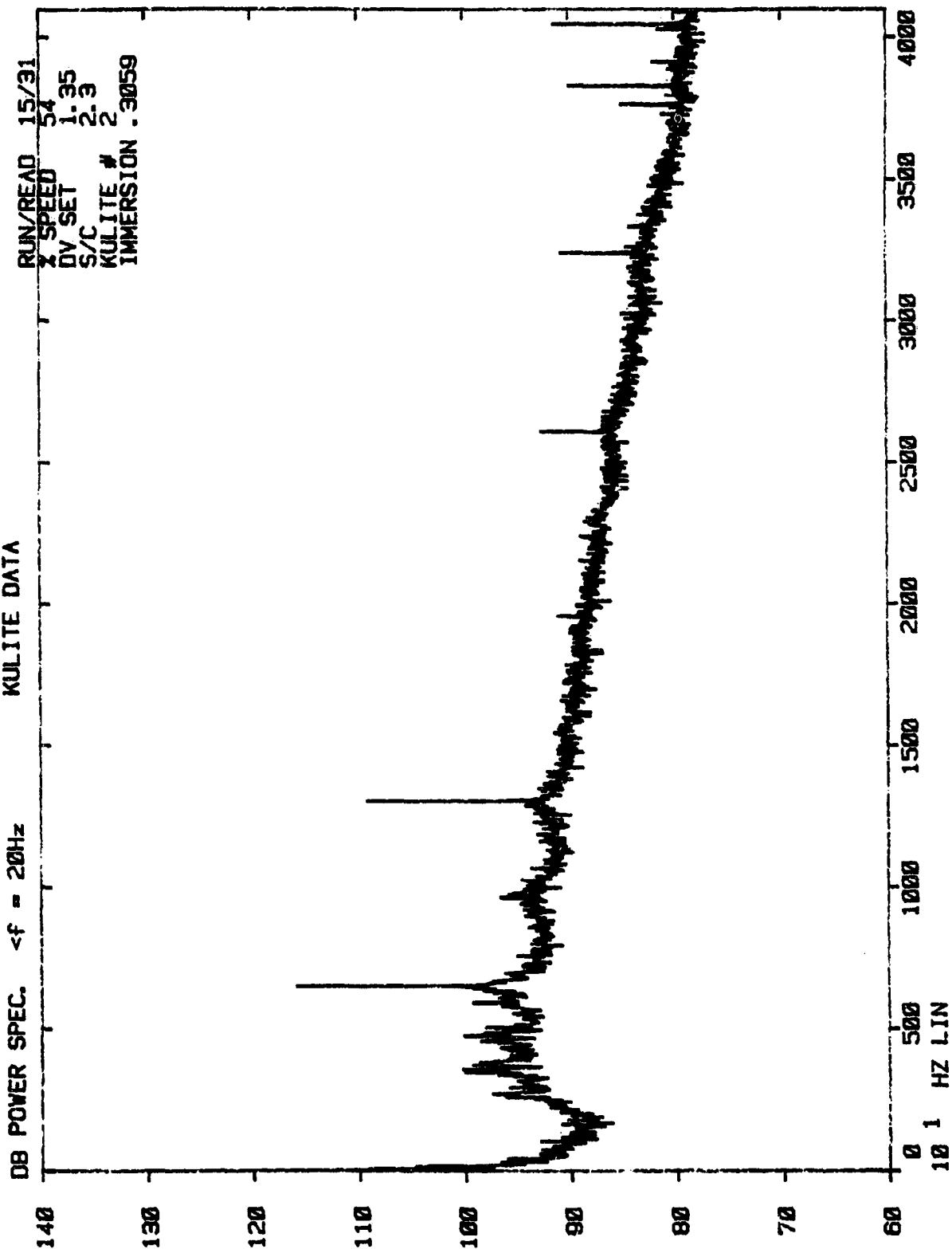
NASA V/B STUDY KULITE DATA

DB POWER SPEC. $\leq f = 20\text{Hz}$

RUN/READ 15/4
X SPEED 54
DV SET 1.35
S/C 2.3
KULITE # 4
IMMERSION .0243

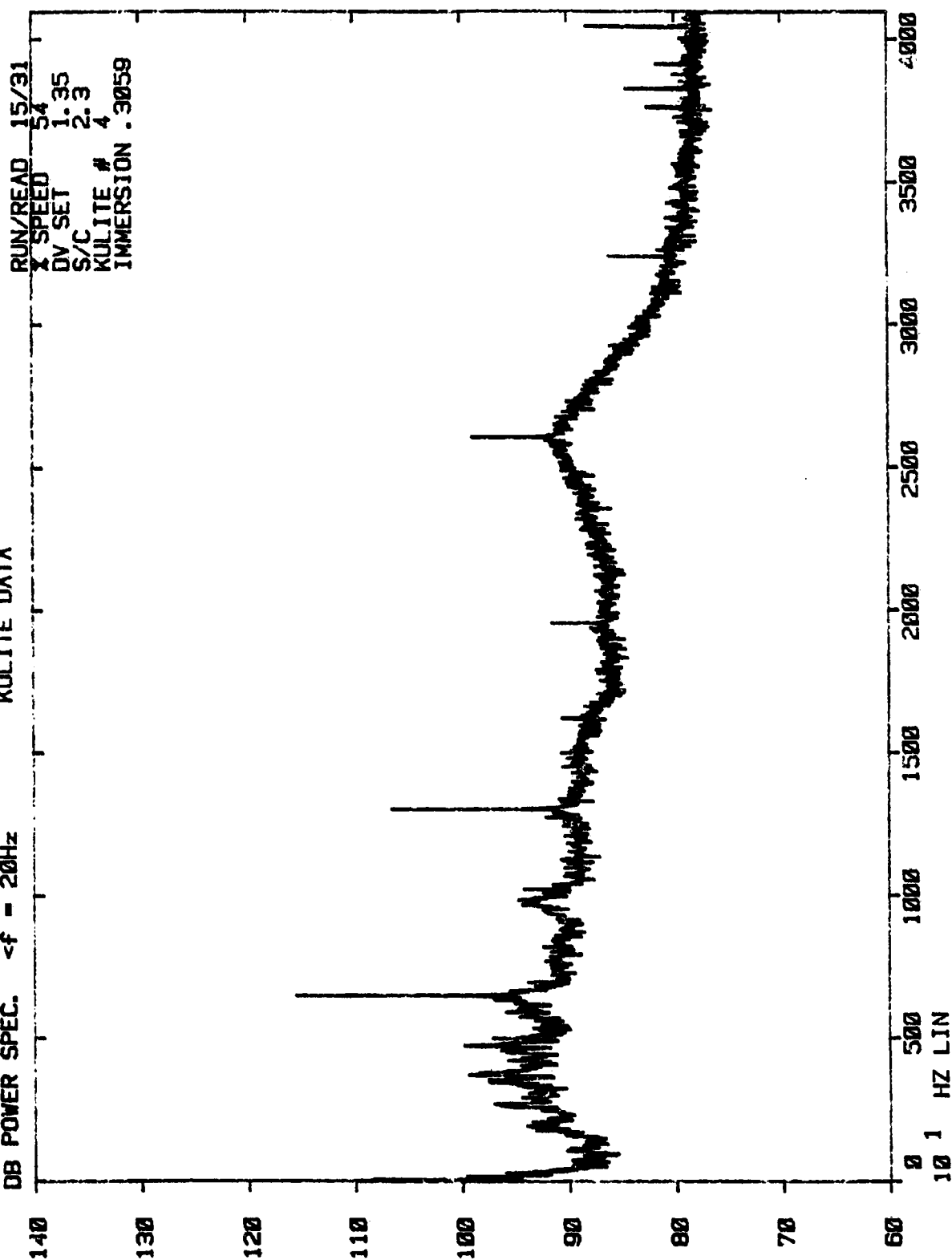


NASA V/B STUDY KULITE DATA



NASA V/B STUDY KULITE DATA

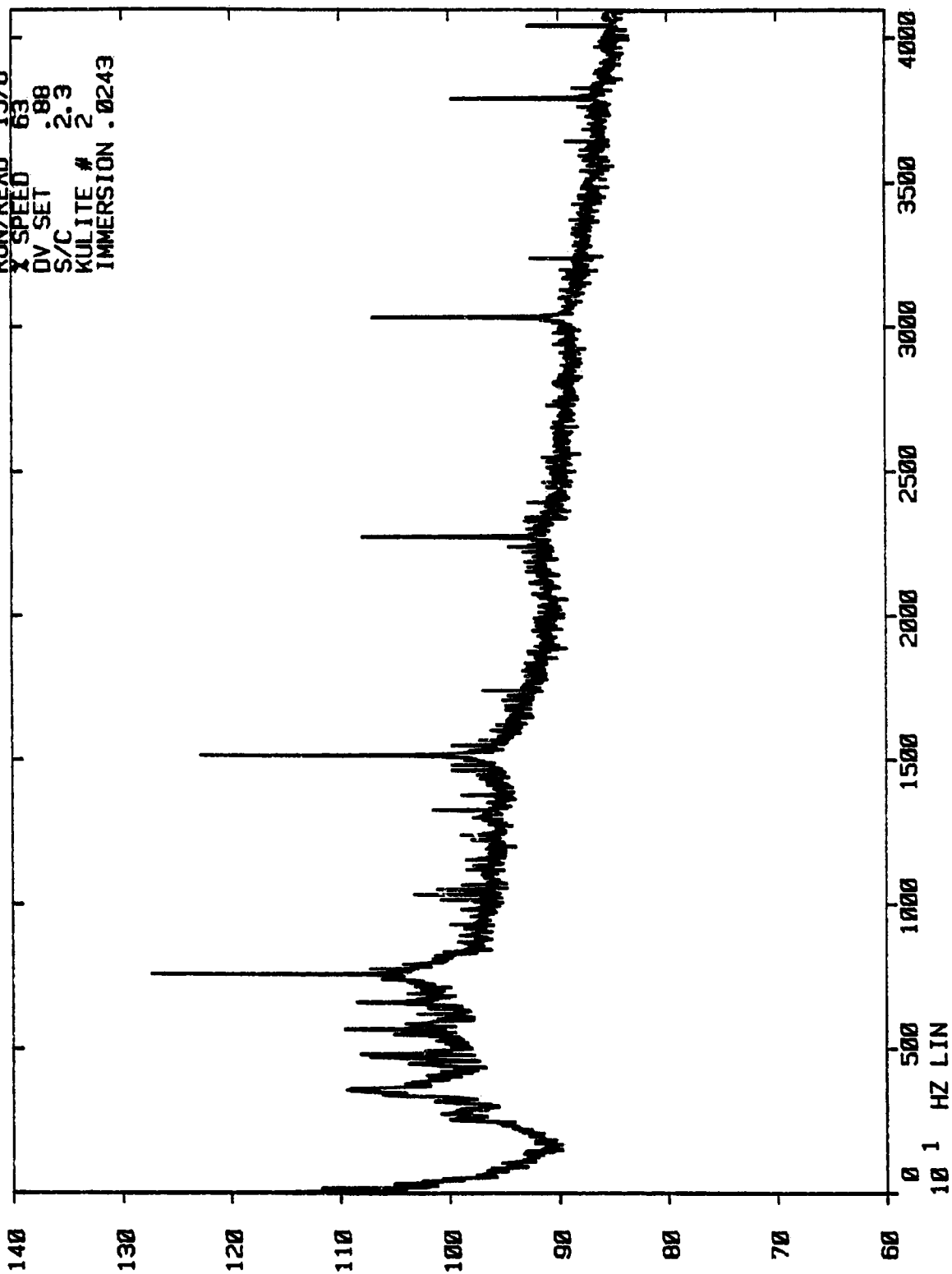
DB POWER SPEC. $< f = 20\text{Hz}$



NASA V/B STUDY
KULITE DATA

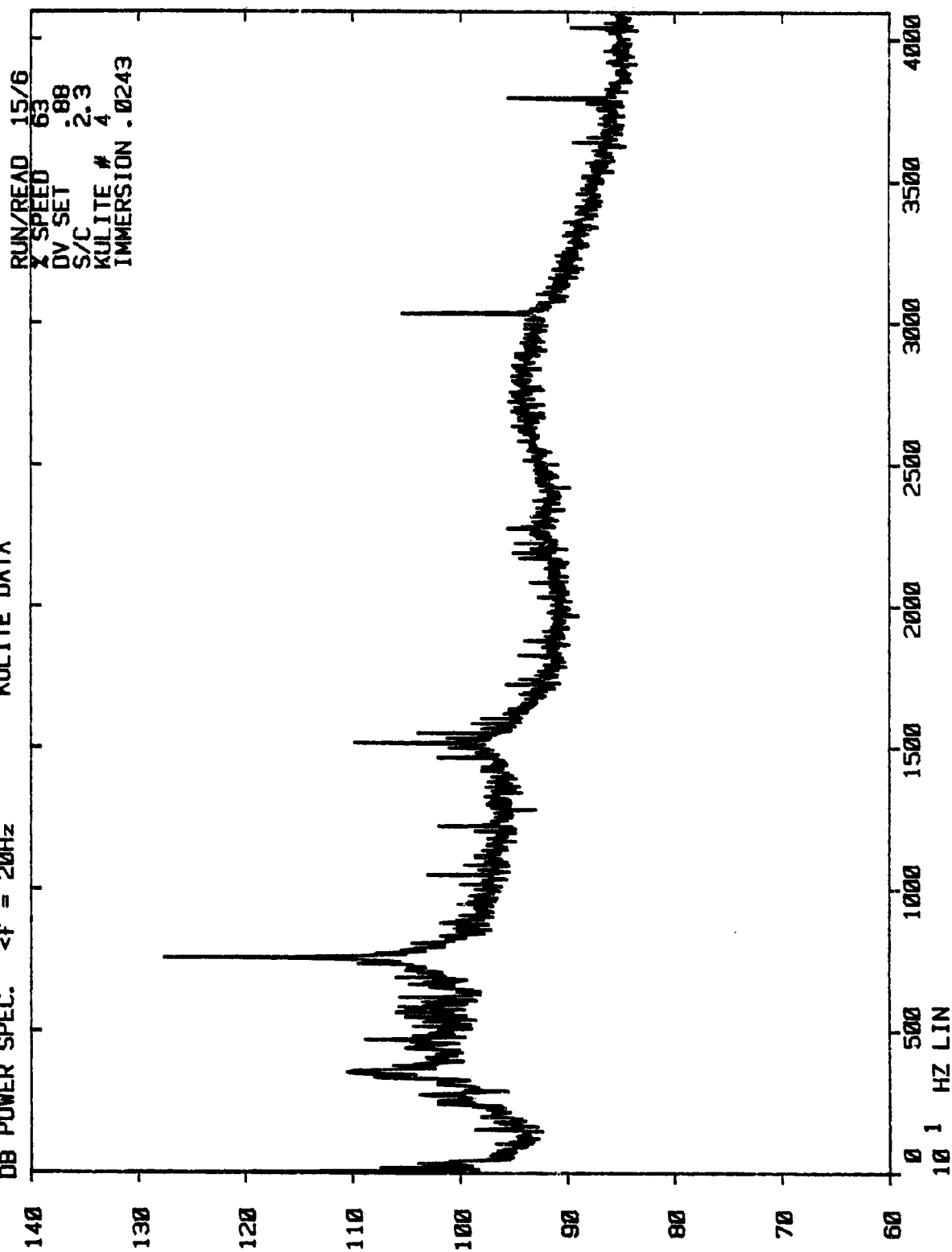
DB POWER SPEC. $<f = 20\text{Hz}$

RUN/READ 15/6
X SPEED 63
DV SET .88
S/C 2.3
KULITE # 2
IMMERSION .0243



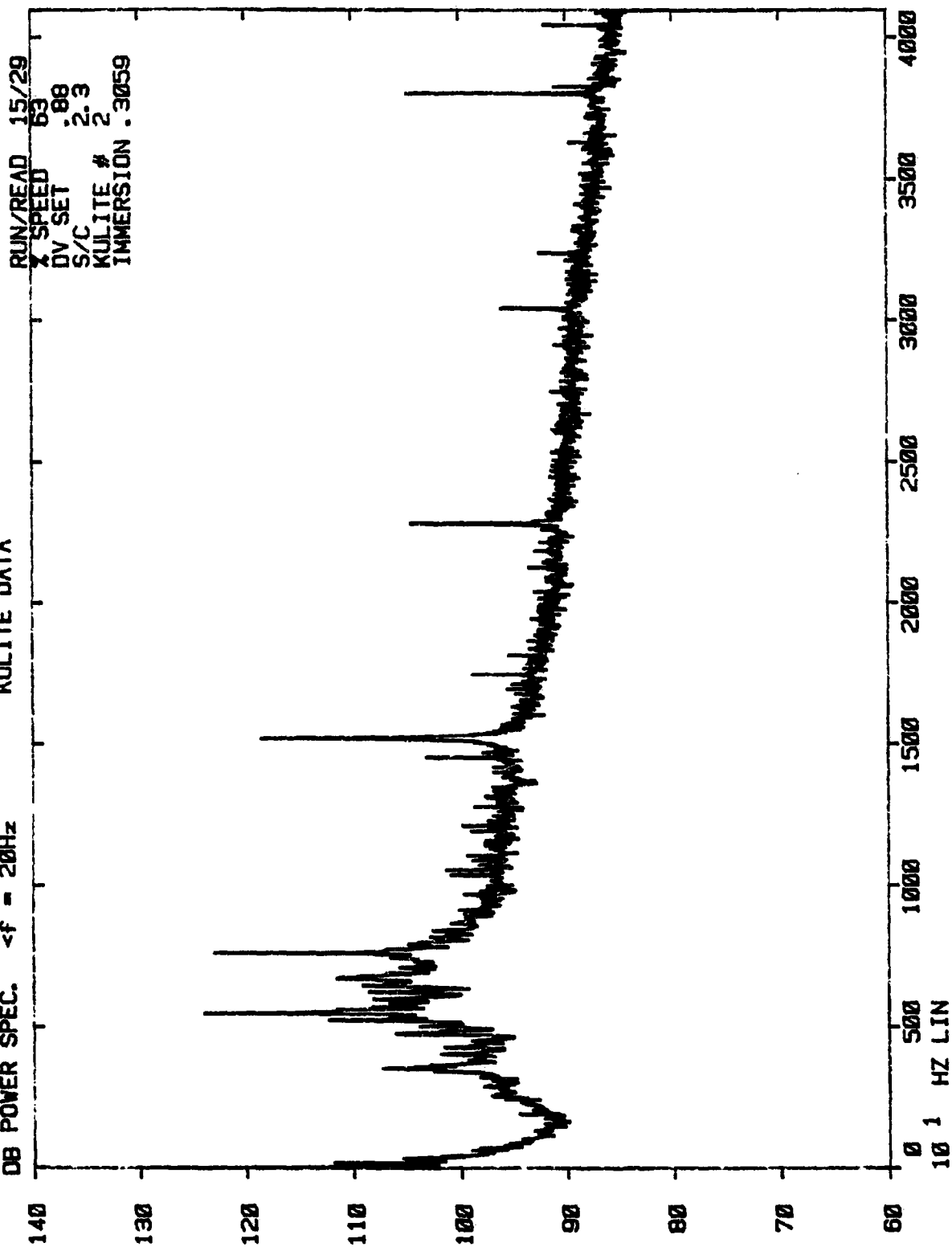
NASA V/B STUDY KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$



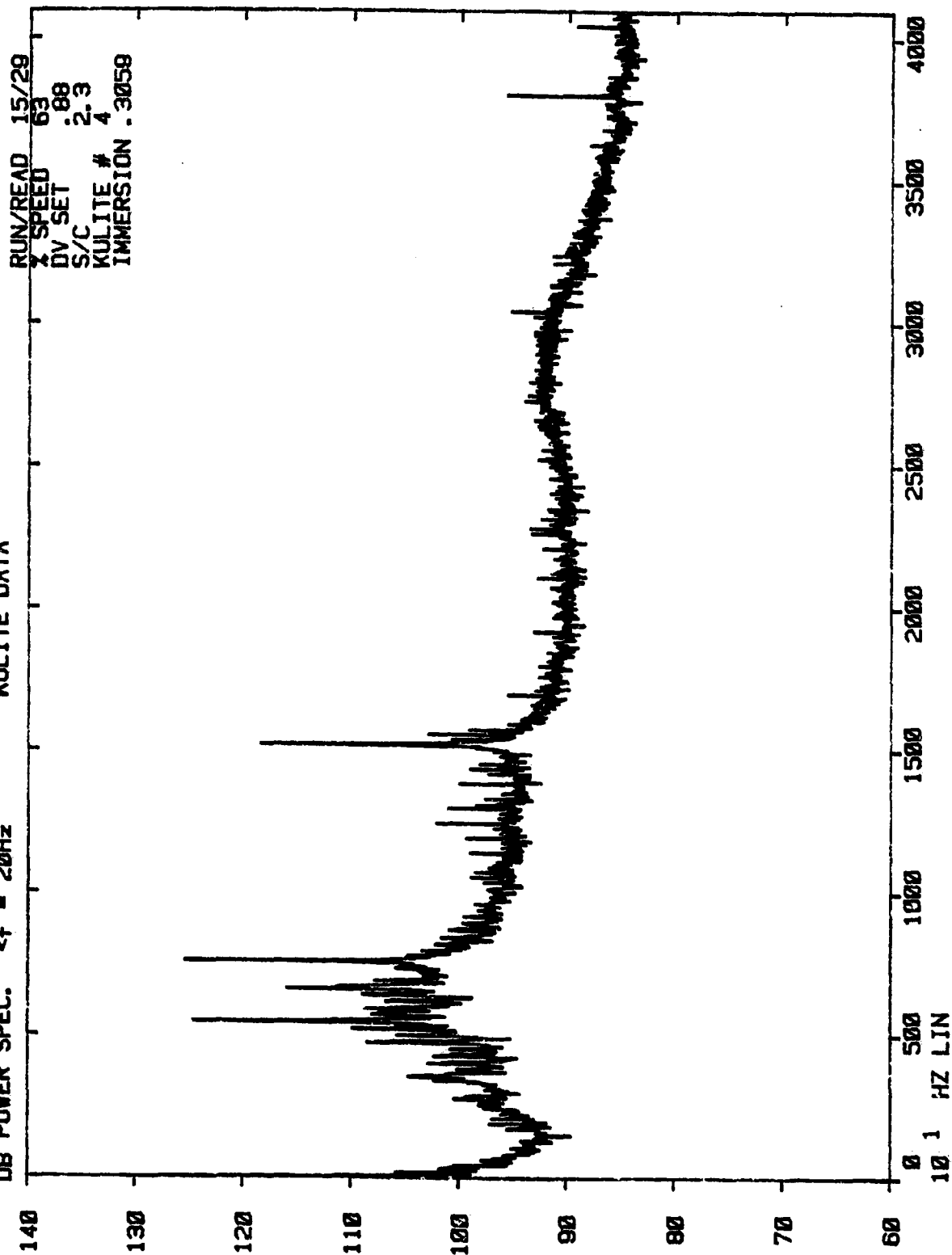
NASA V/B STUDY
KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$



NASA V/B STUDY
KULITE DATA

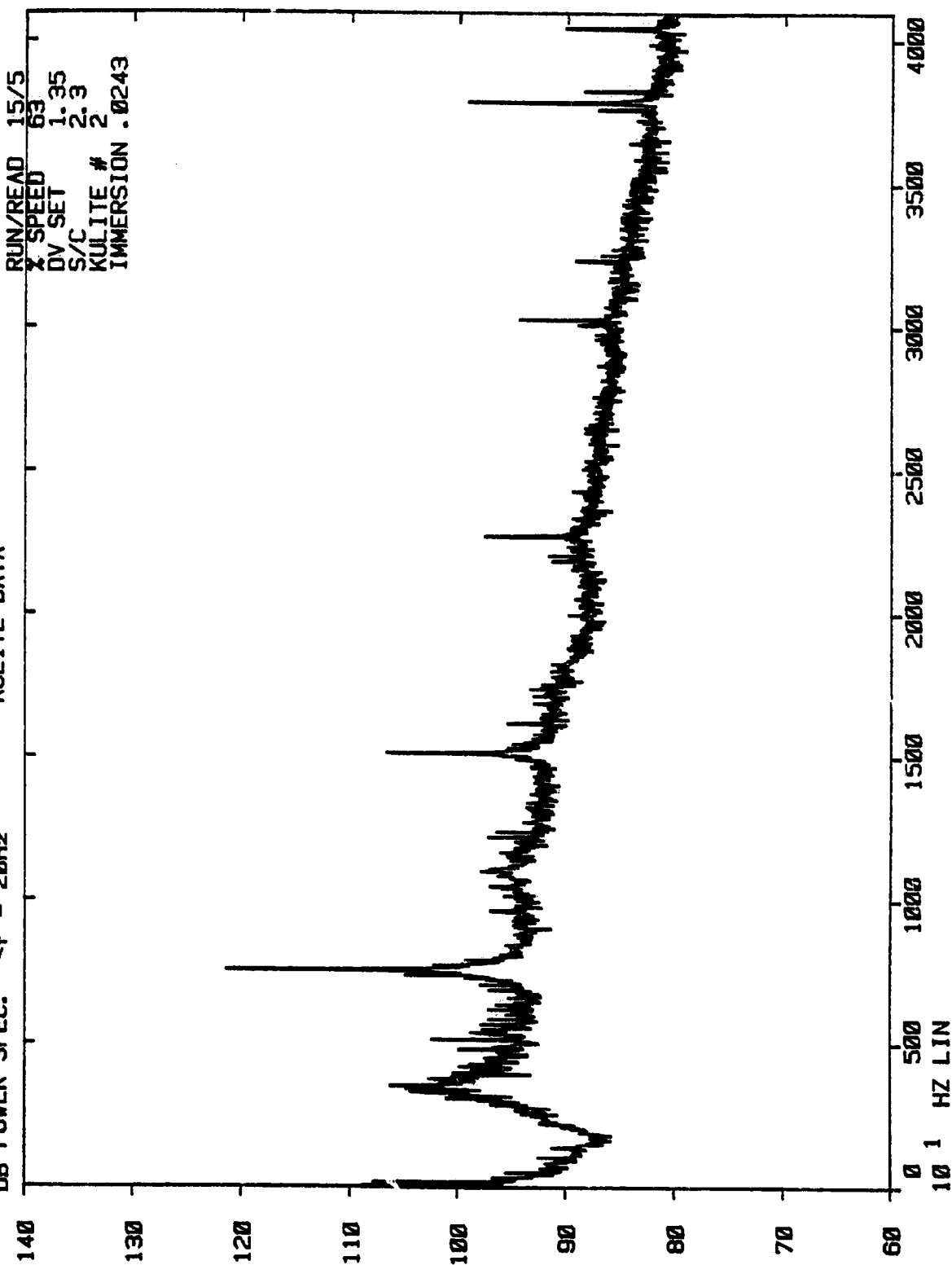
DB POWER SPEC. $< f = 20\text{Hz}$



RUN/READ 15/29
SPEED 63
DV SET .88
S/C 2.3
KULITE # 4
IMMERSION .3058

NASA V/B STUDY KULITE DATA

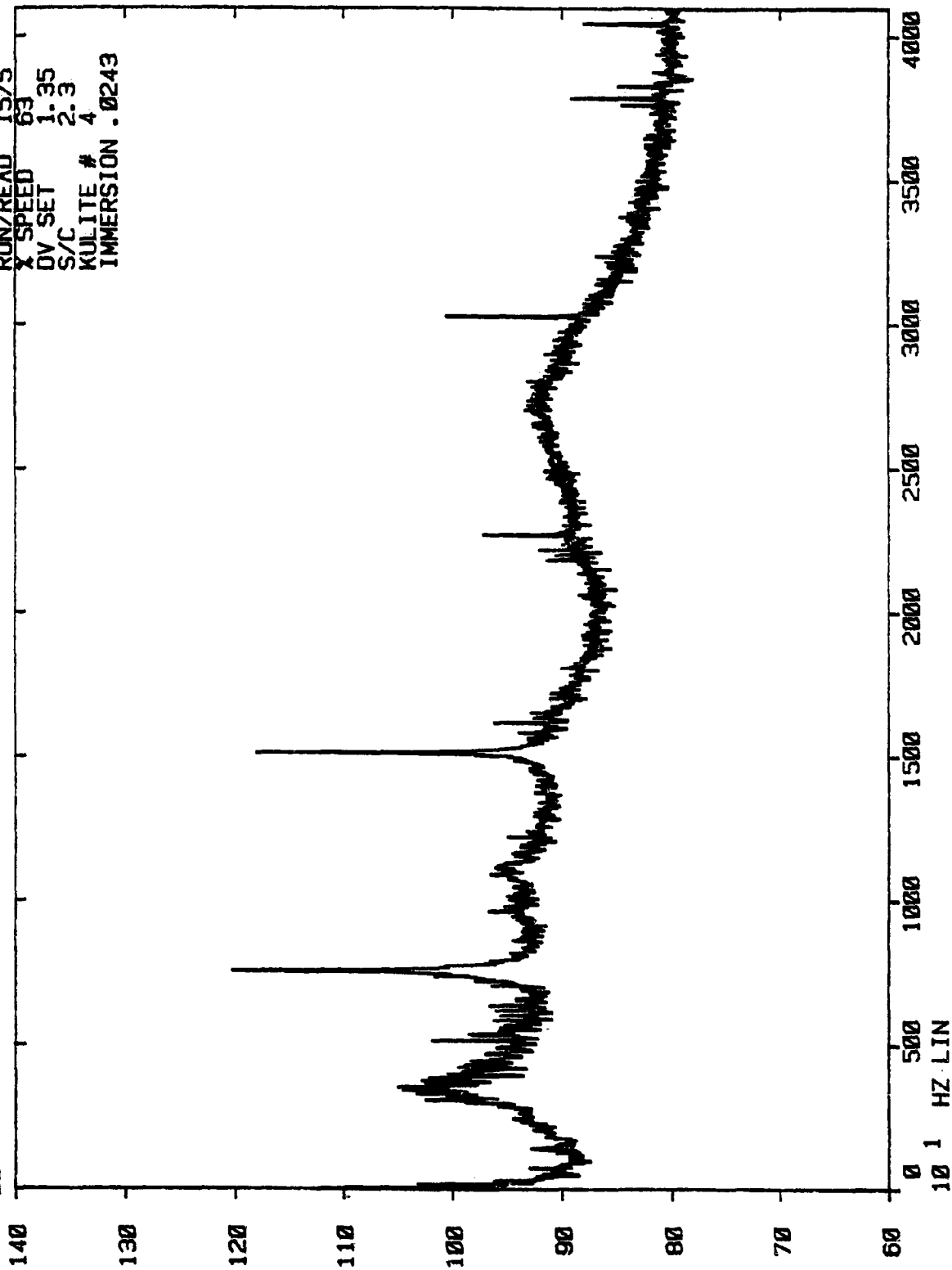
DB POWER SPEC. $\langle f = 20\text{Hz} \rangle$



NASA V/B STUDY KULITE DATA

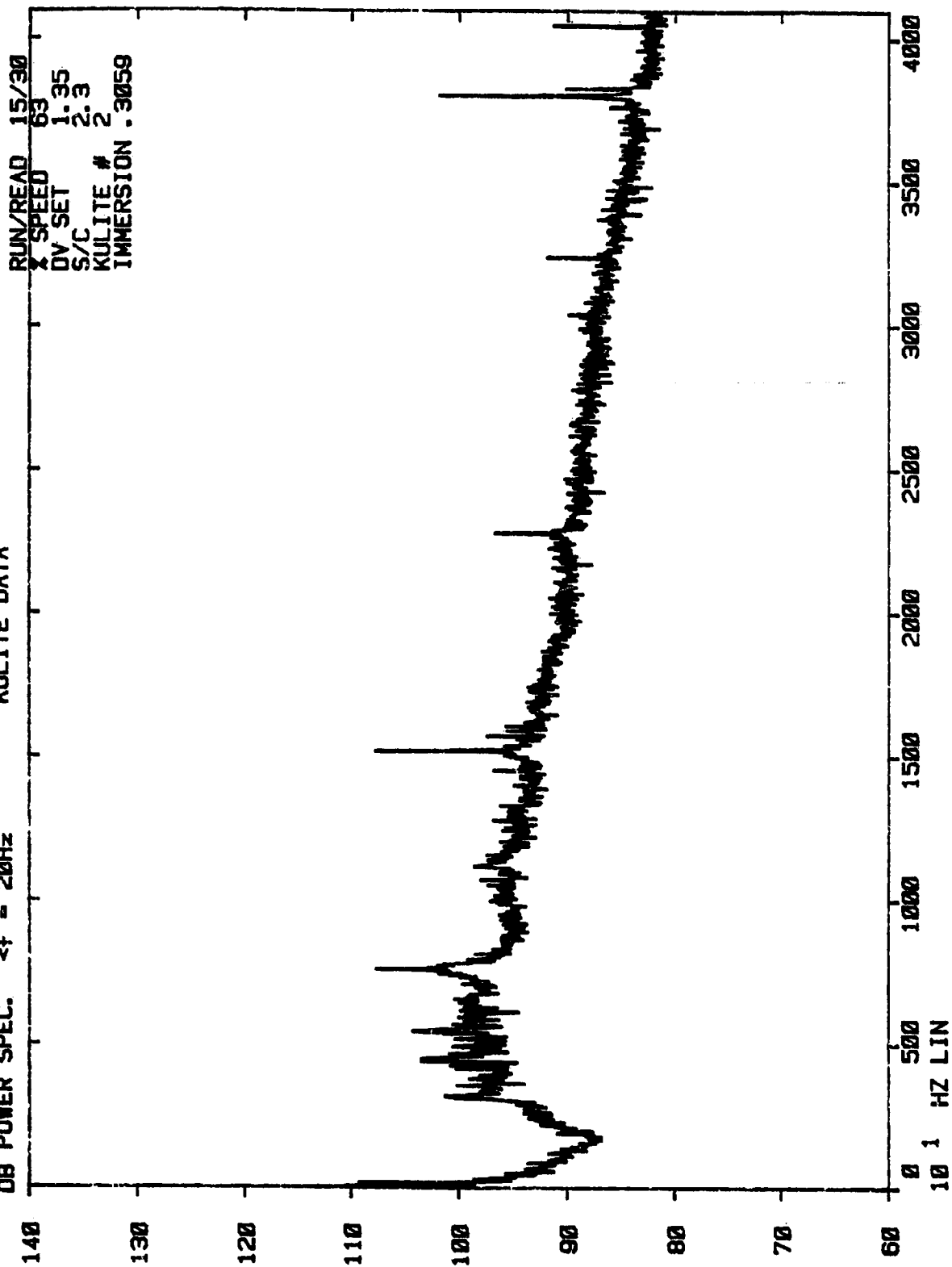
DB POWER SPEC. $\Delta f = 20\text{Hz}$

RUN/READ 15/5
X SPEED 63
DV SET 1.35
S/C 2.3
KULITE # 4
IMMERSION .0243



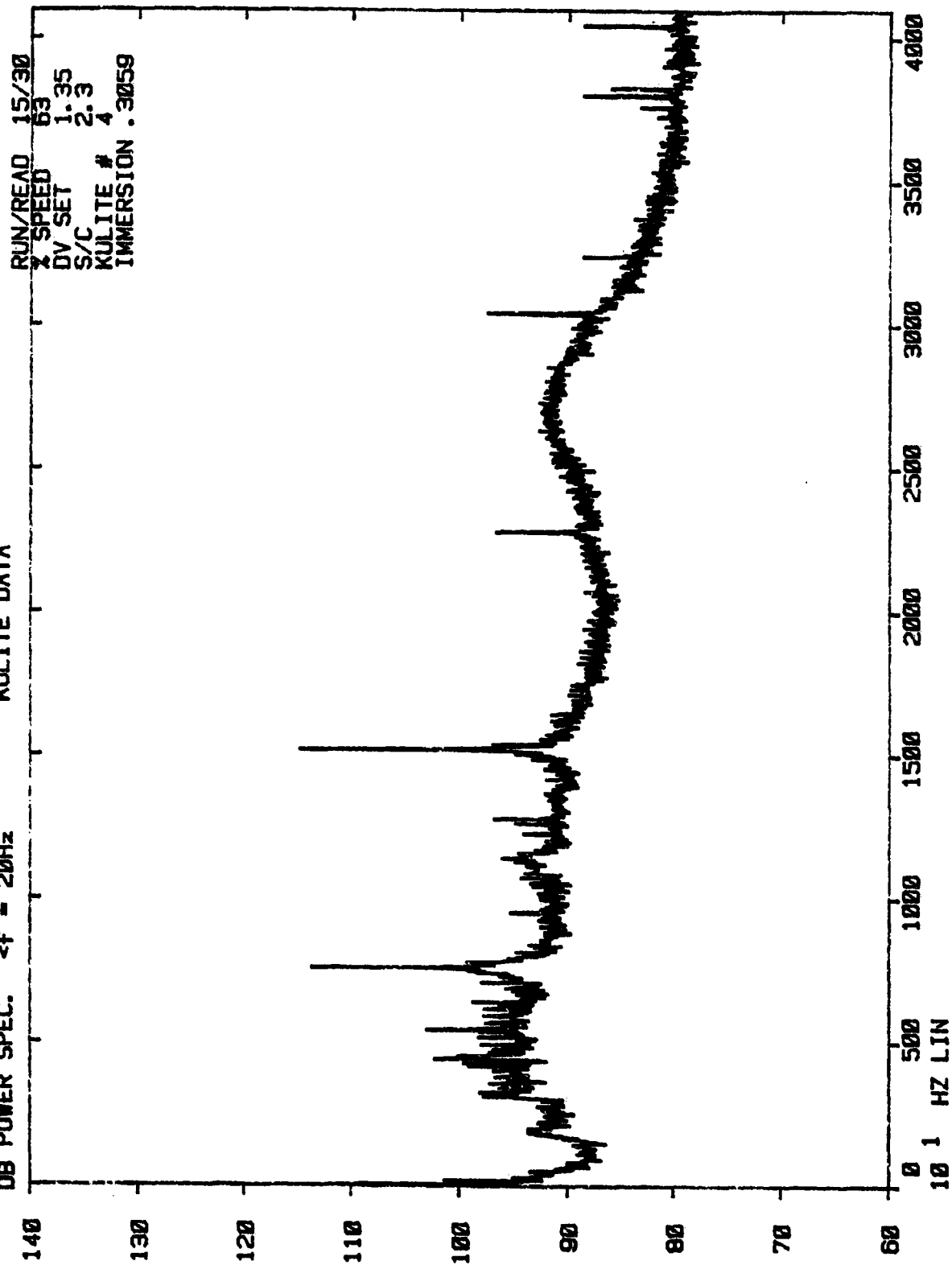
NASA V/B STUDY KULITE DATA

DB POWER SPEC. $<f = 20\text{Hz}$



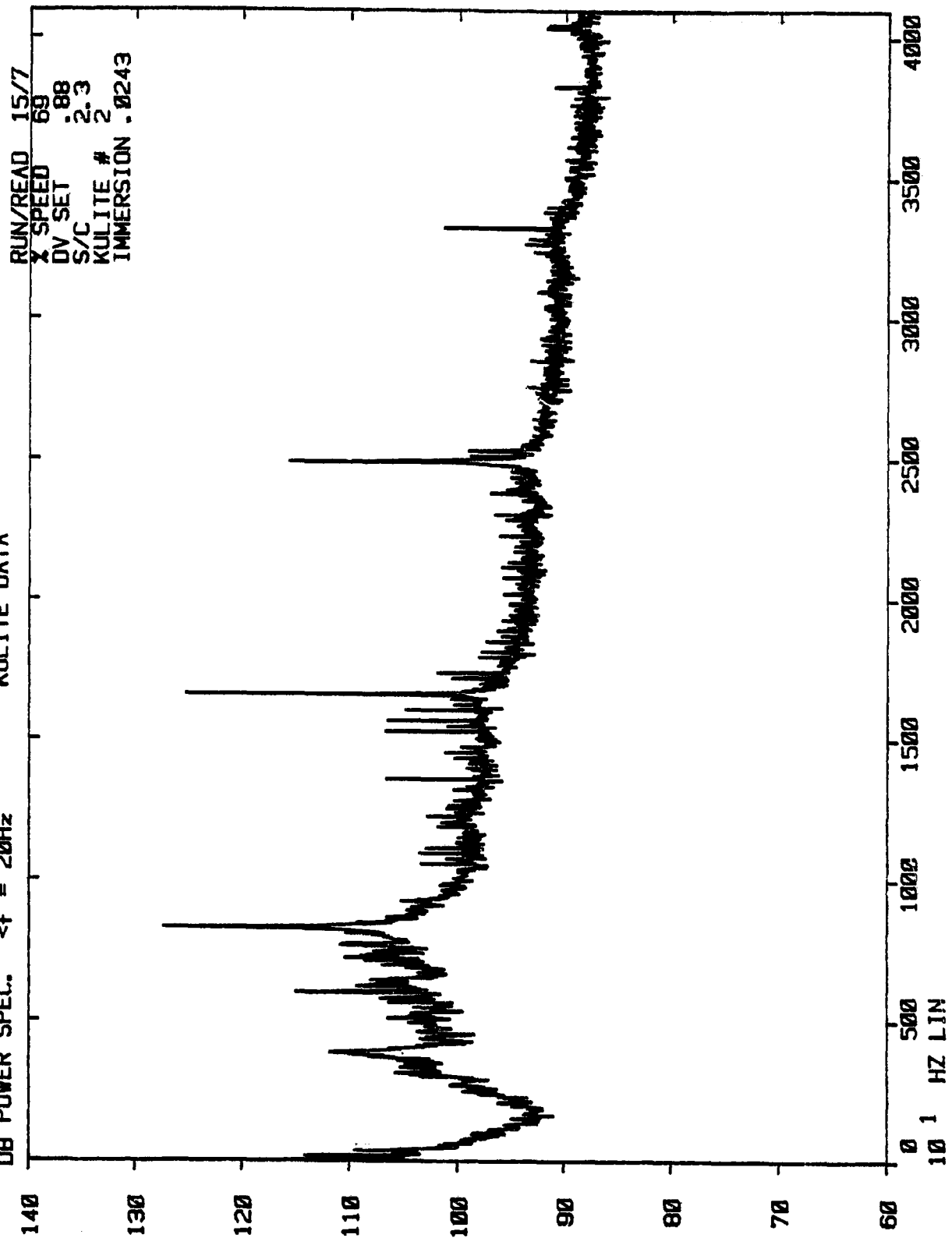
NASA V/B STUDY KULITE DATA

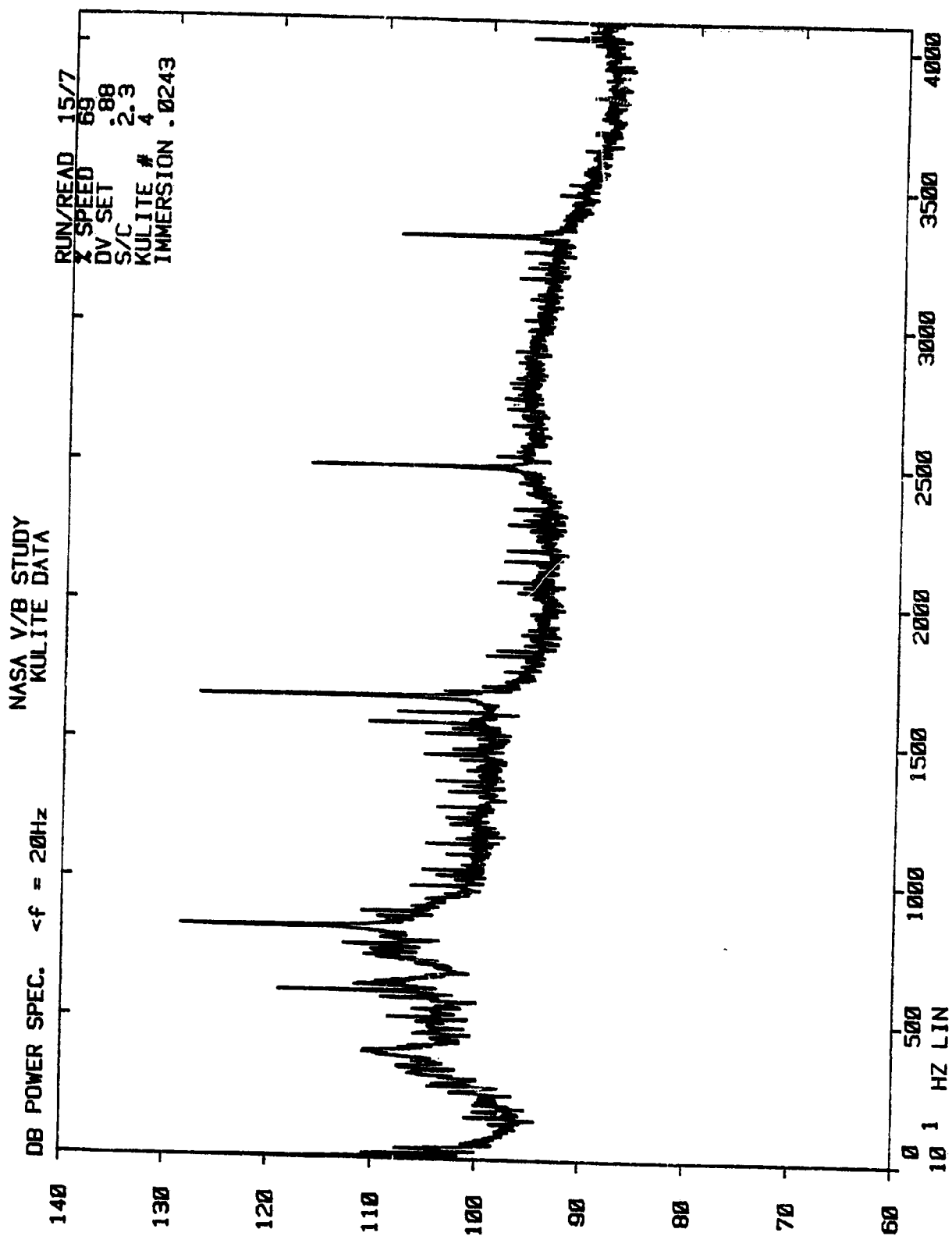
DB POWER SPEC. $\Delta f = 20\text{Hz}$

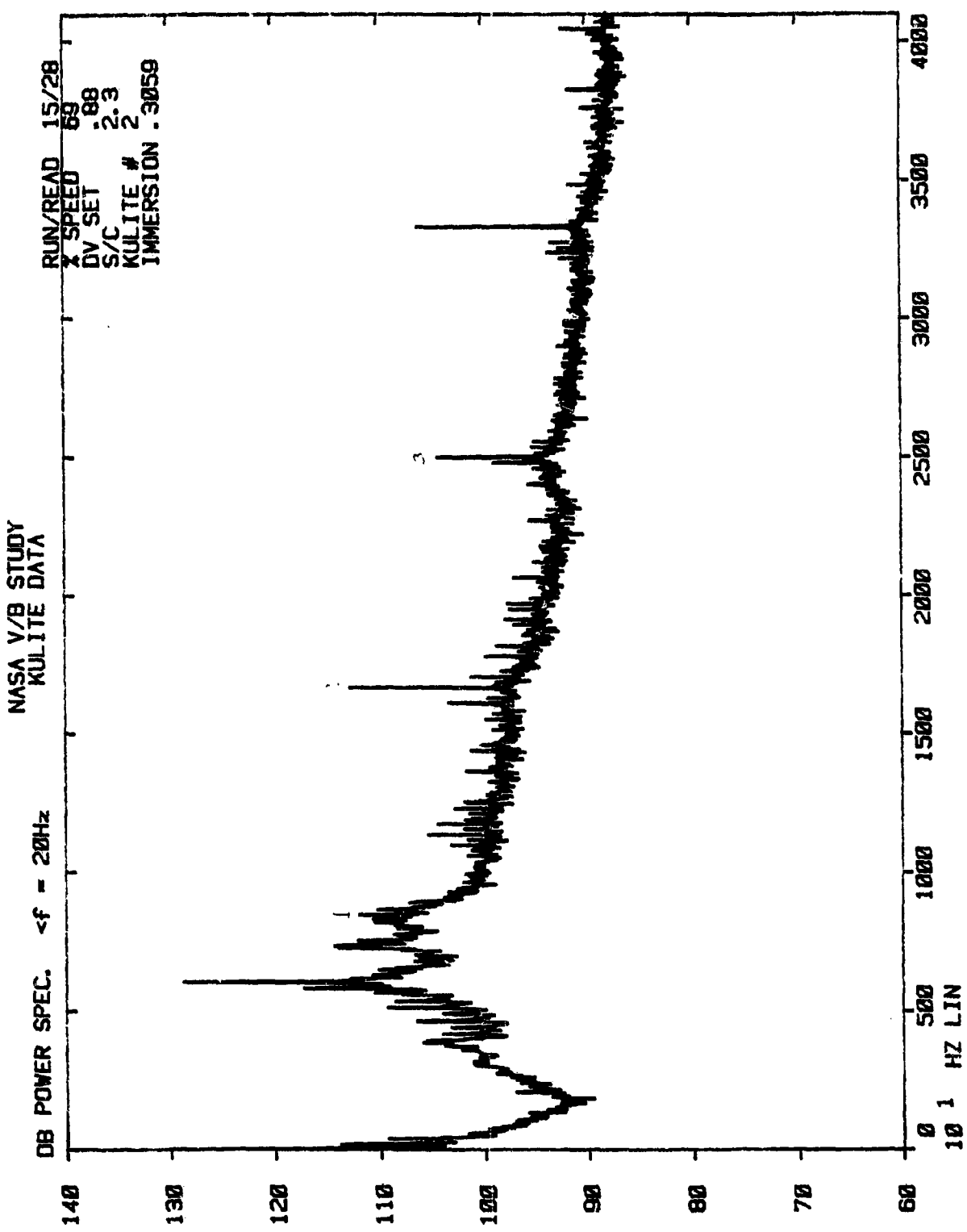


NASA V/B STUDY KULITE DATA

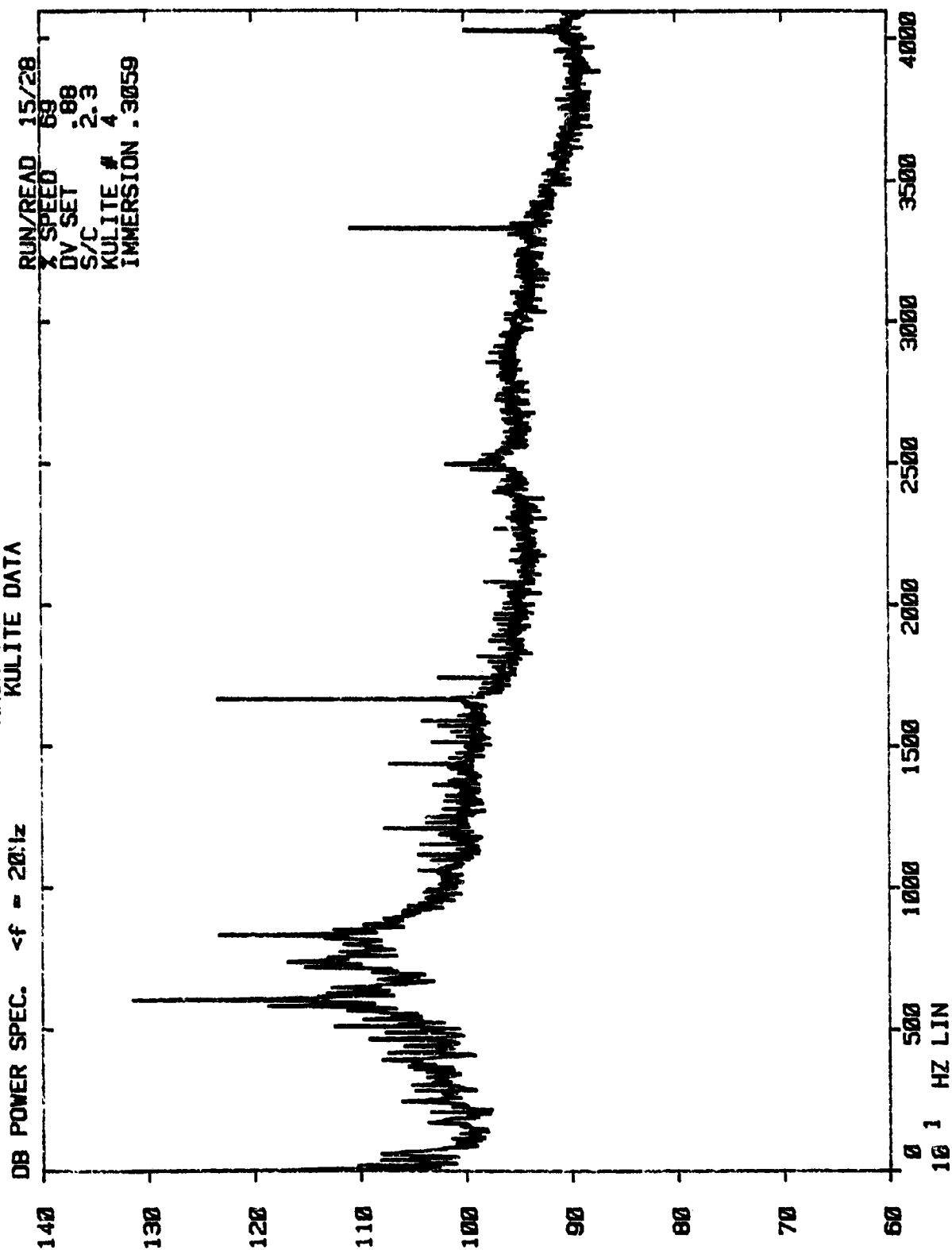
DB POWER SPEC. $\Delta f = 20\text{Hz}$







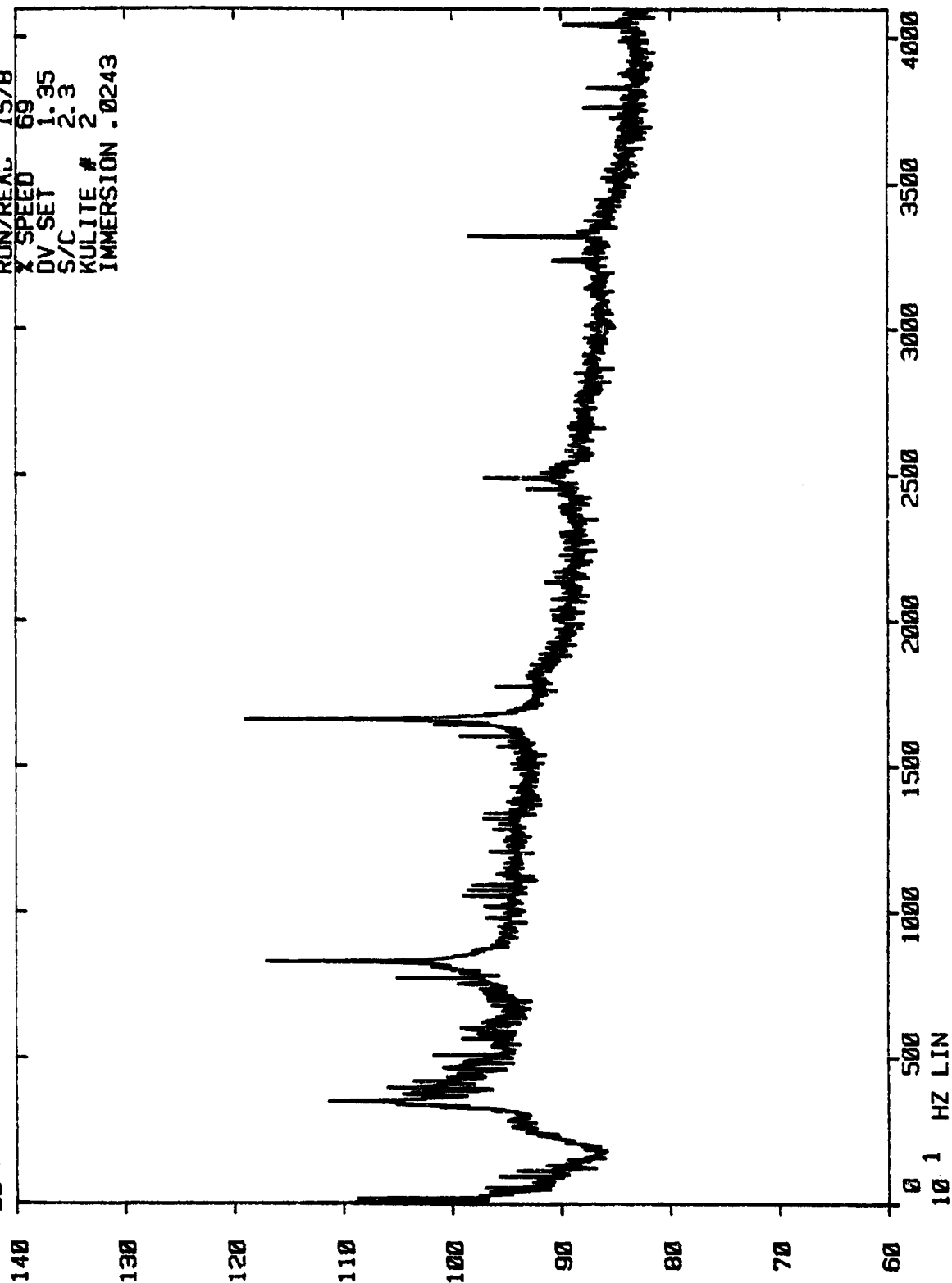
NASA V/B STUDY KULITE DATA



NASA V/B STUDY KULITE DATA

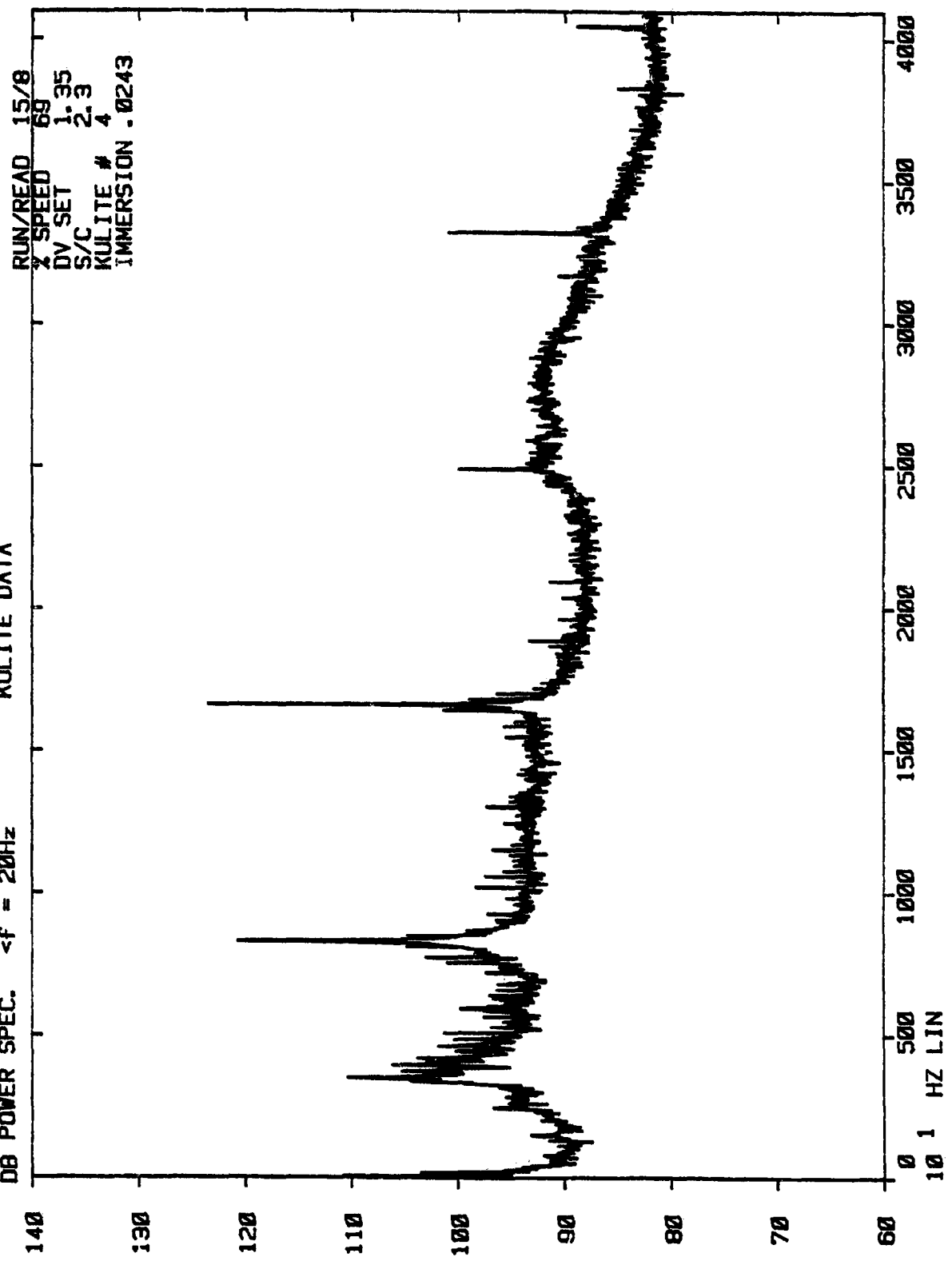
DB POWER SPEC. $\Delta f = 20\text{Hz}$

RUN/READ 15/8
X SPEED 69
DV SET 1.35
S/C 2.3
KULITE # 2
IMMERSION .0243



NASA V/B STUDY KULITE DATA

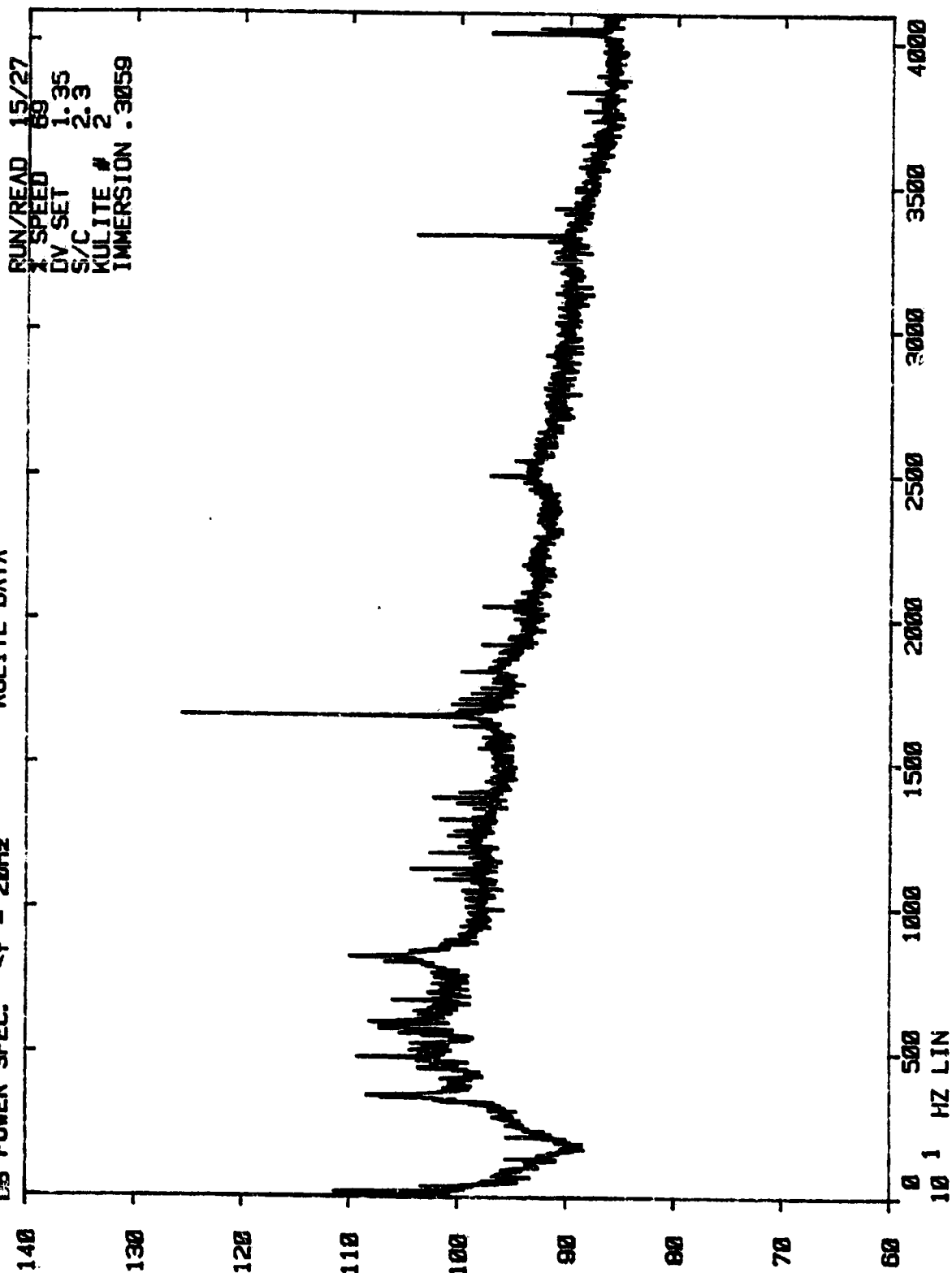
DB POWER SPEC. $\Delta f = 20\text{Hz}$



RUN/READ 15/8
X SPEED 69
DV SET 1.35
S/C 2.3
KULITE # 4
IMMERSION .0243

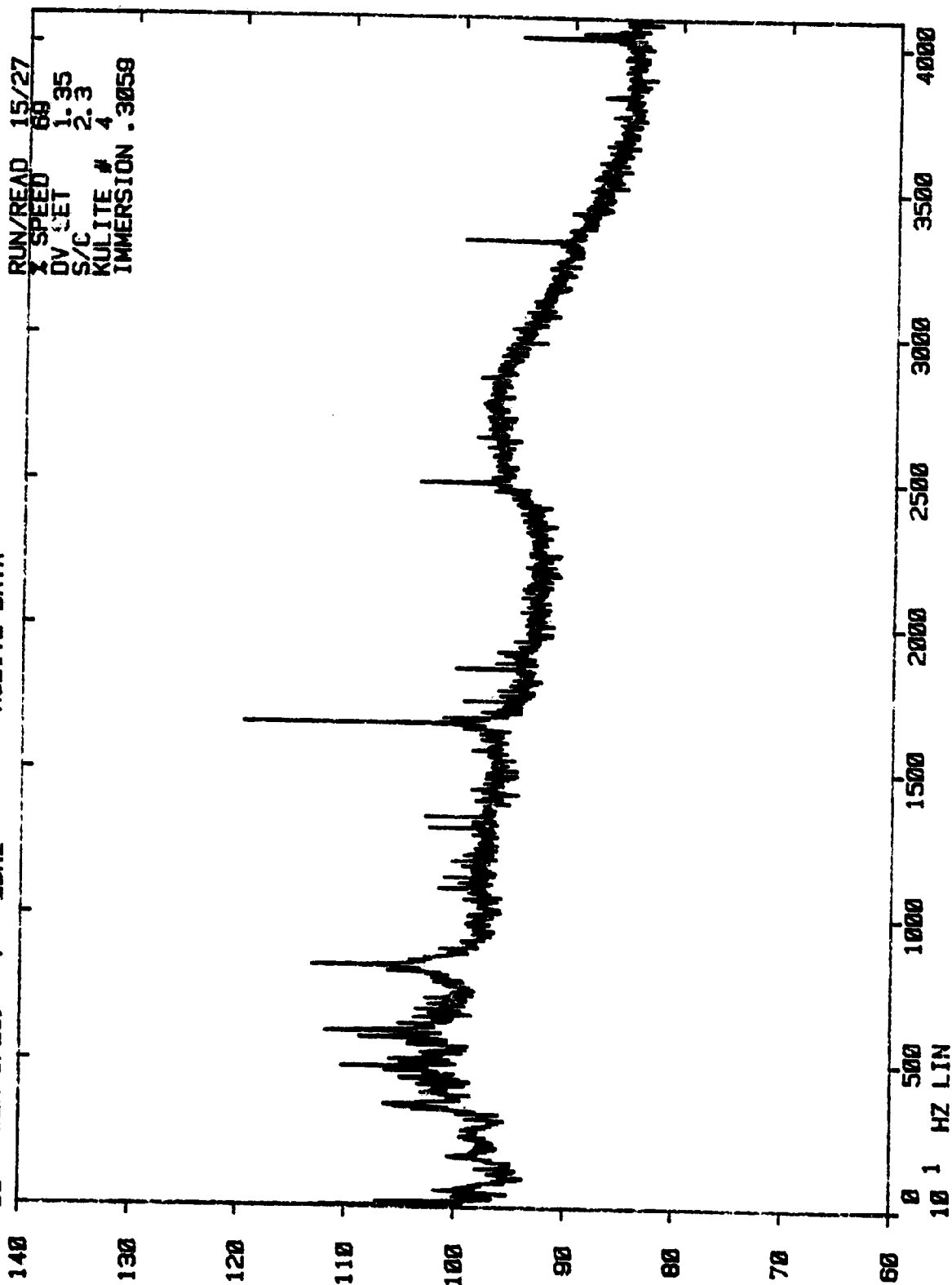
NASA V/B STUDY KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$



NASA V/B STUDY
KULITE DATA

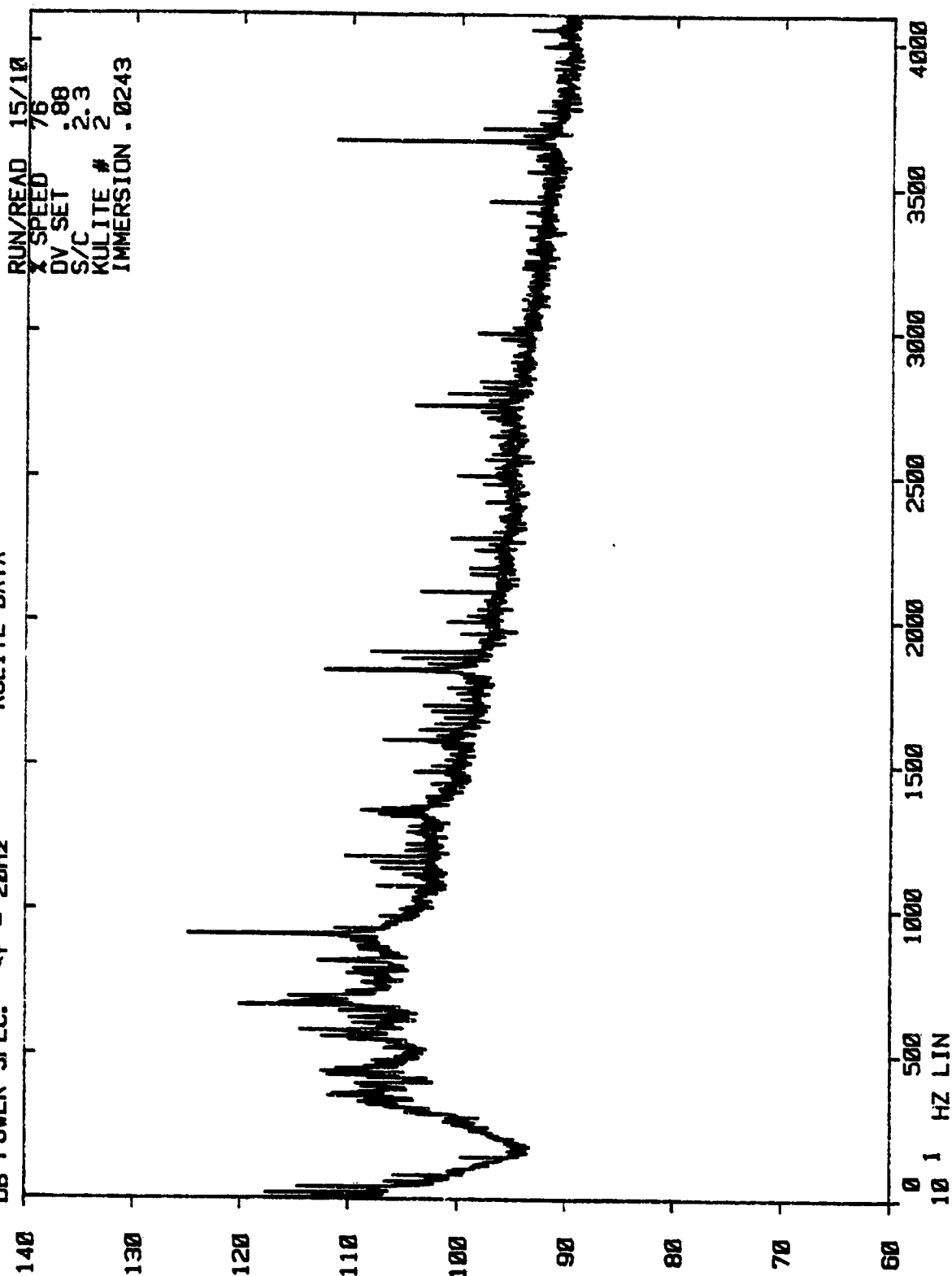
DB POWER SPEC. $<f = 20\text{Hz}$



RUN/READ 15/27
X SPEED 89
DV SET 1.35
S/C 2.3
KULITE # 4
IMMERSION .3059

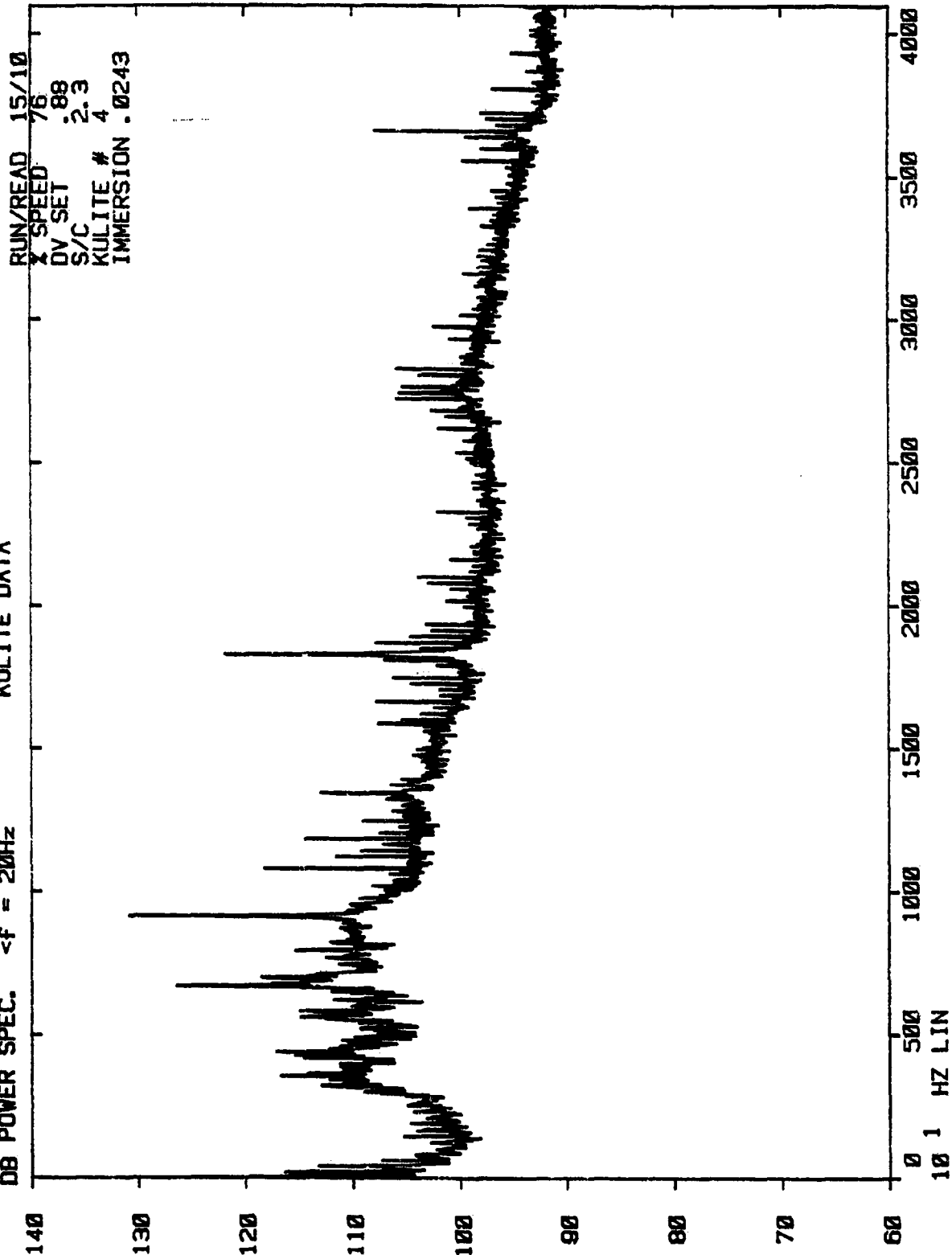
NASA V/B STUDY
KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$



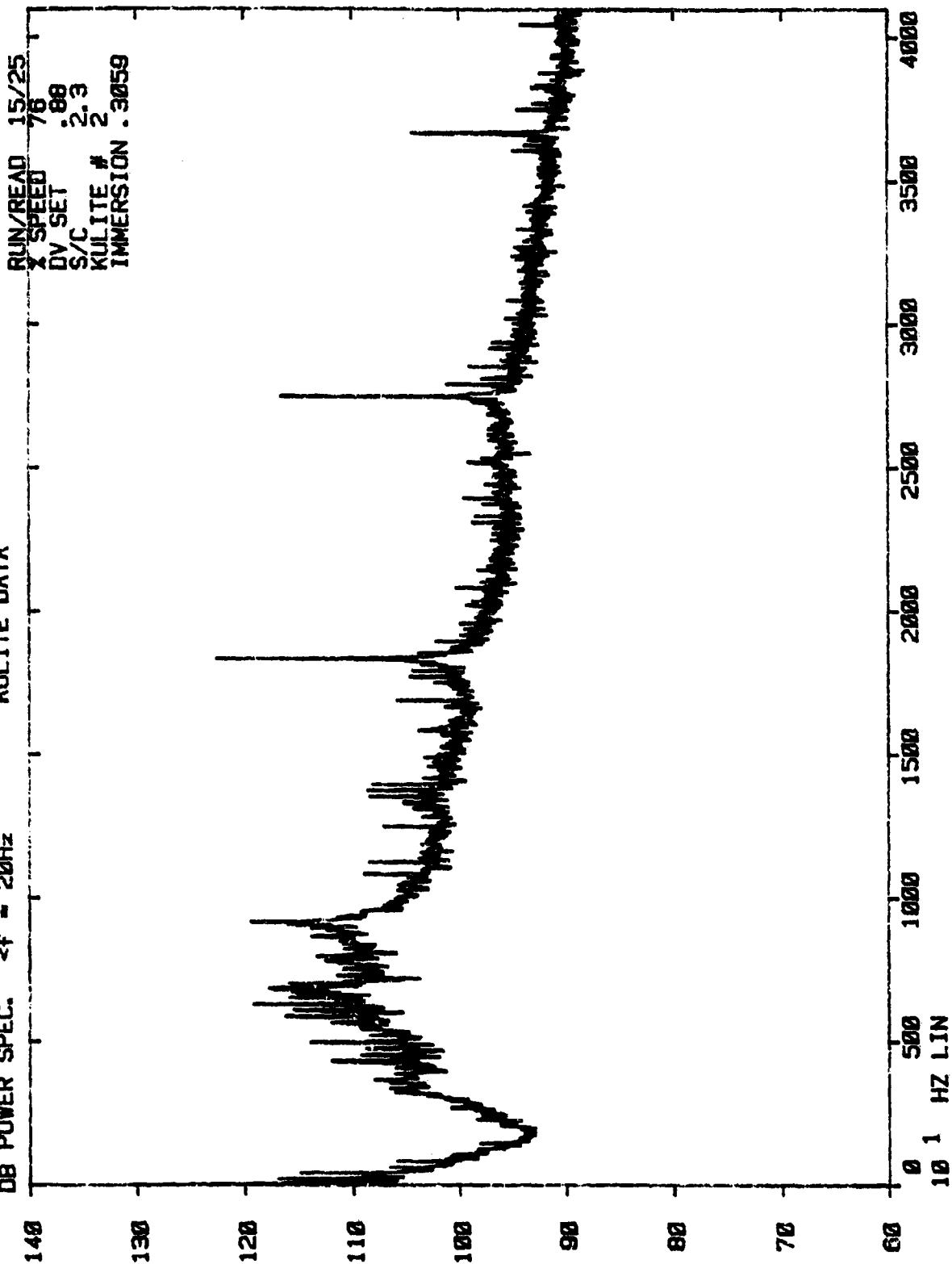
NASA V/B STUDY
KULITE DATA

DB POWER SPEC. $<f = 20\text{Hz}$



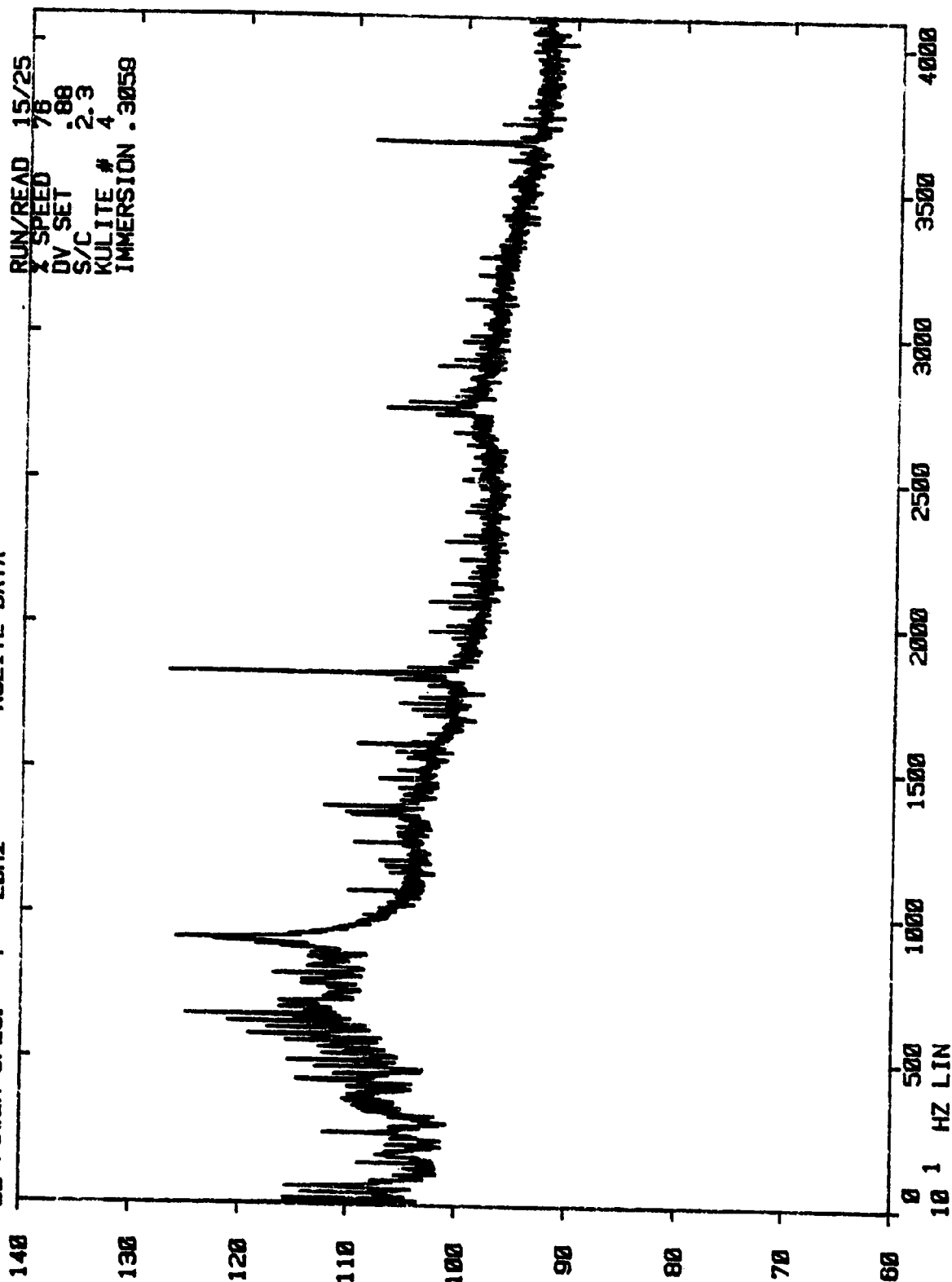
NASA V/B STUDY
KULITE DATA

DB POWER SPEC. $< f = 20\text{Hz}$



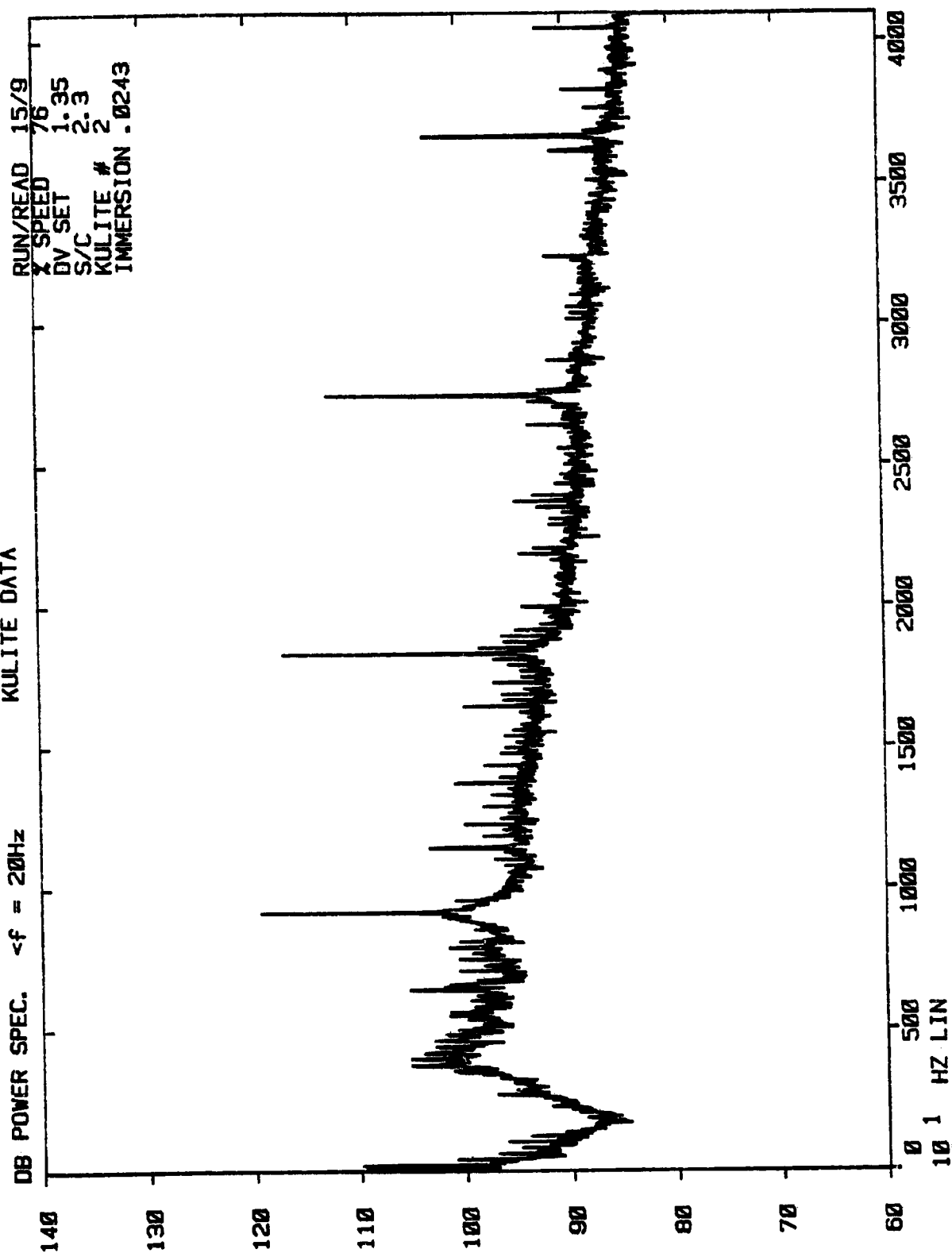
NASA V/B STUDY
KULITE DATA

DB POWER SPEC. $< f = 20\text{Hz}$



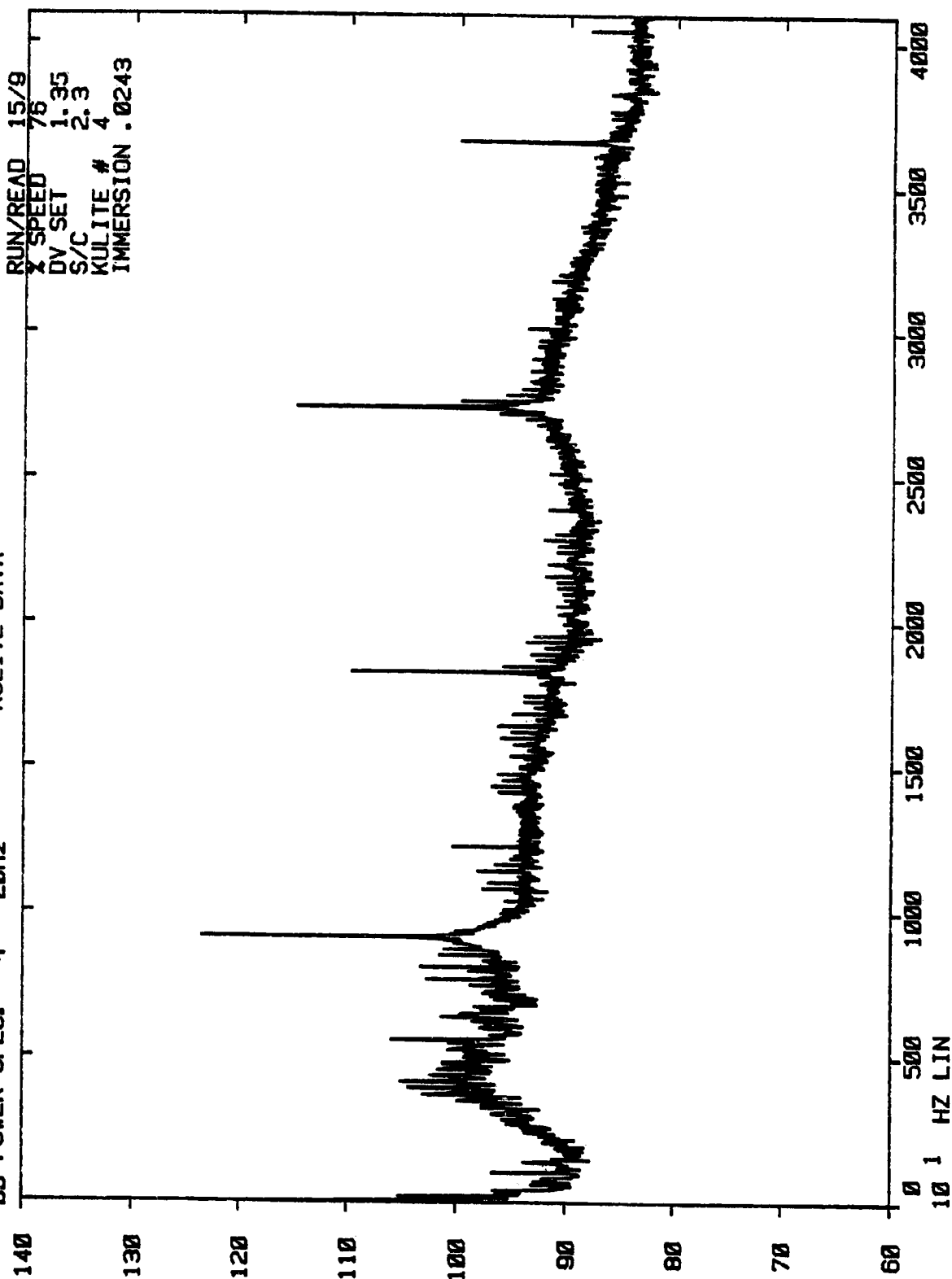
NASA V/B STUDY KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$



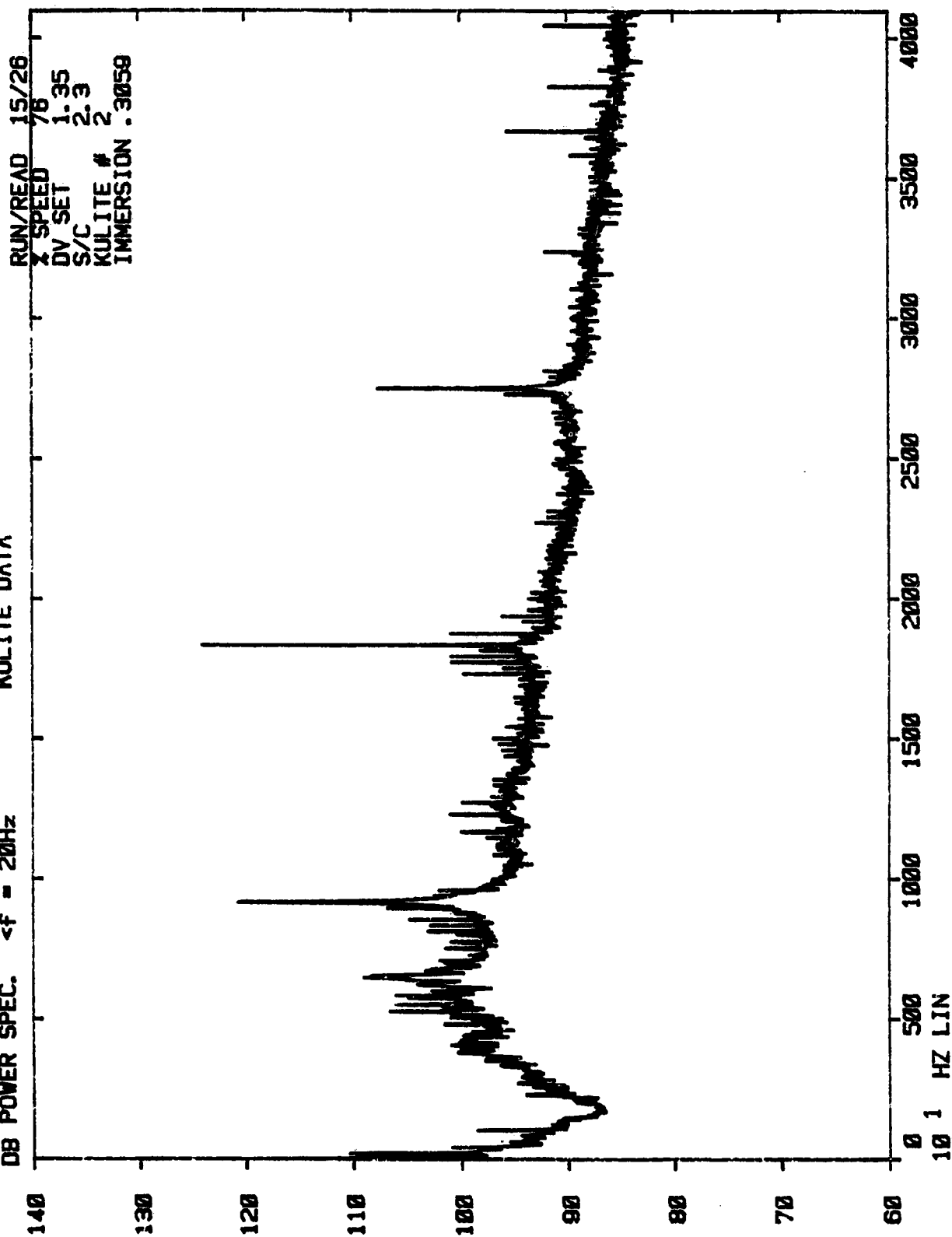
NASA V/B STUDY
KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$



NASA V/B STUDY
KULITE DATA

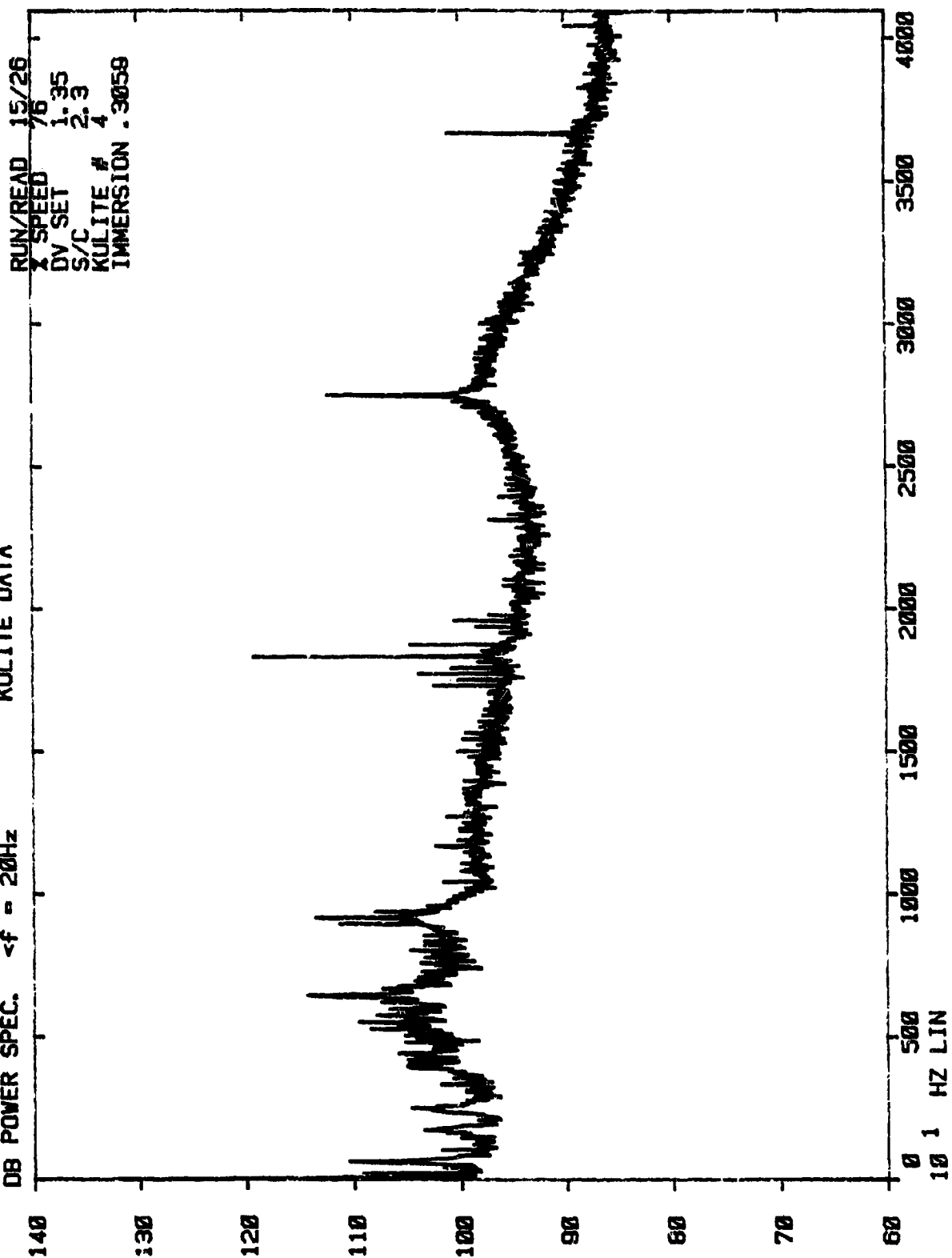
DB POWER SPEC. $\leq f = 20\text{Hz}$



RUN/READ 15/26
X SPEED 76
DV SET 1.35
S/C 2.3
KULITE # 2
IMMERSION .3059

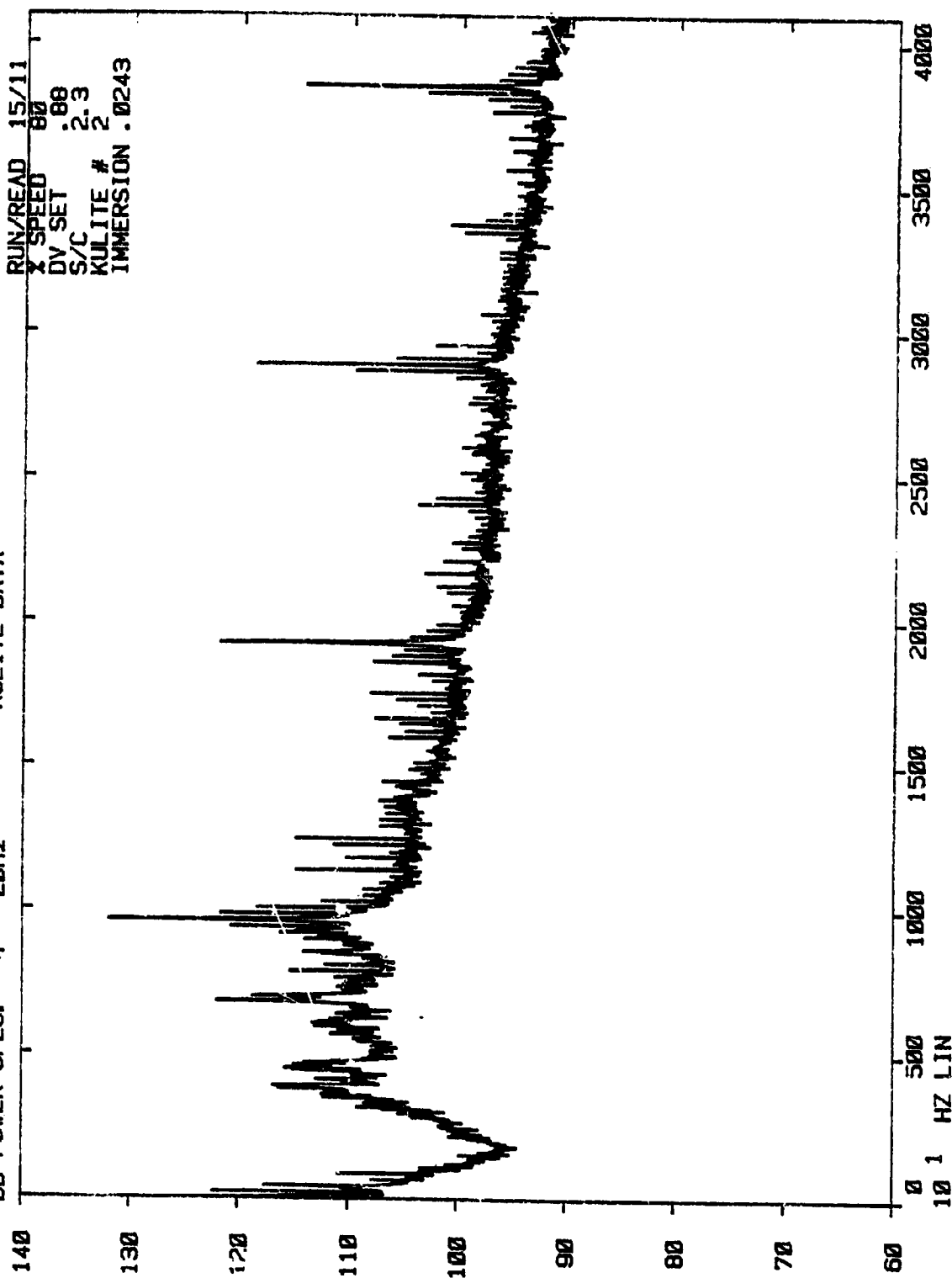
NASA V/B STUDY KULITE DATA

DB POWER SPEC. $<f = 20\text{Hz}$



NASA V/B STUDY KULITE DATA

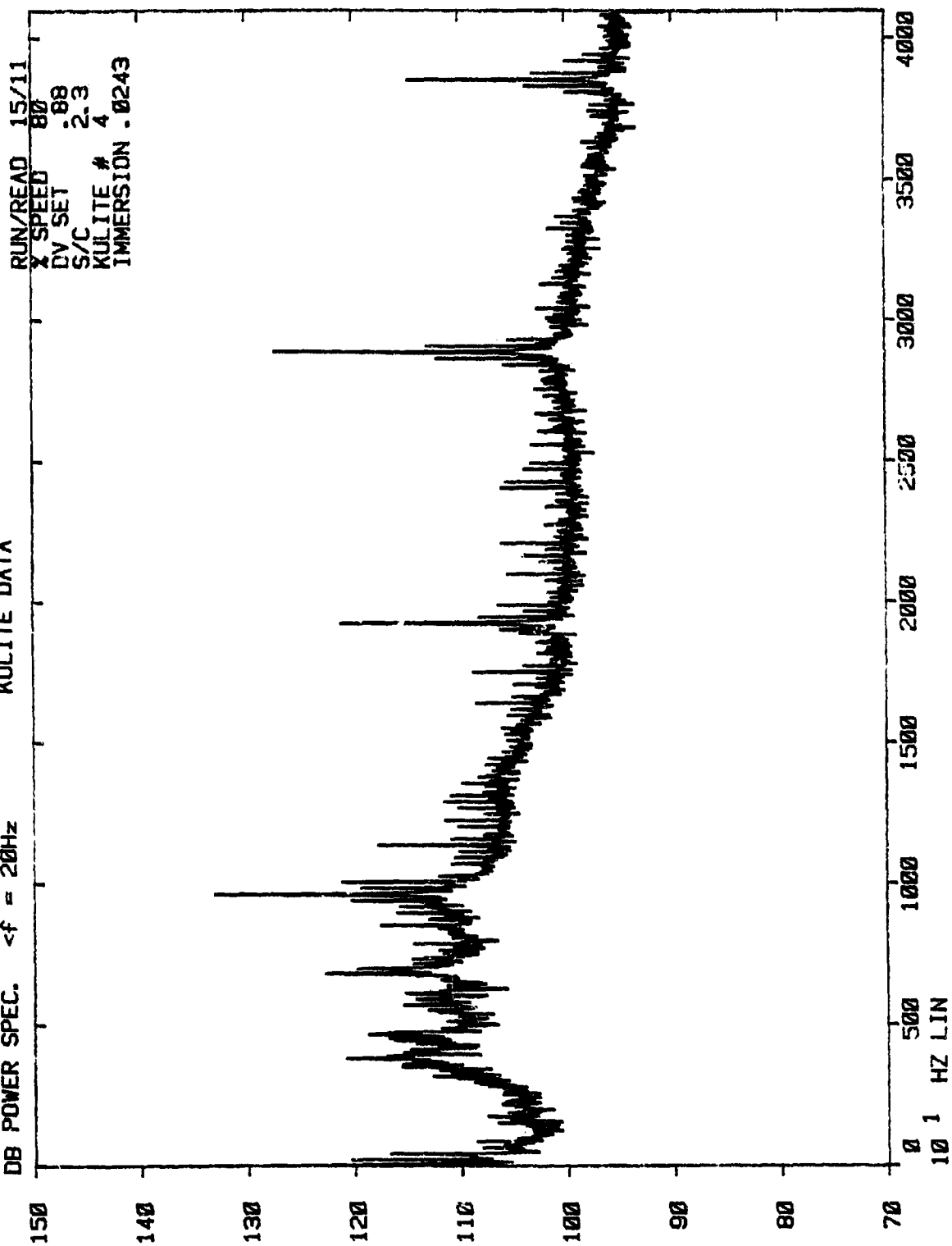
DB POWER SPEC. $< f = 20\text{Hz}$



RUN/READ 15/11
X SPEED 80
DV SET .88
S/C 2.3
KULITE # 2
IMMERSION .0243

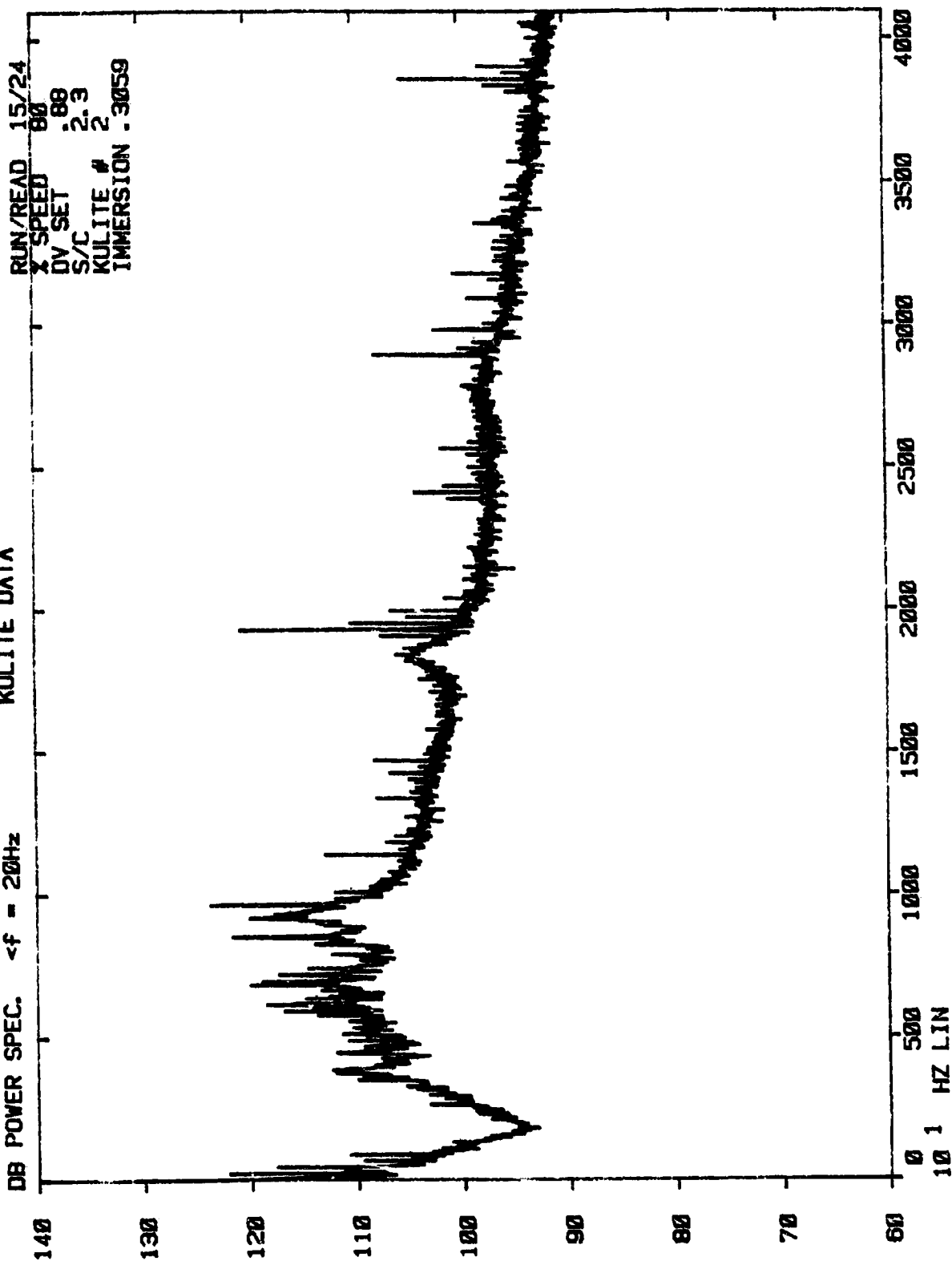
NASA V/B STUDY KULITE DATA

DB POWER SPEC. $< f = 20\text{Hz}$



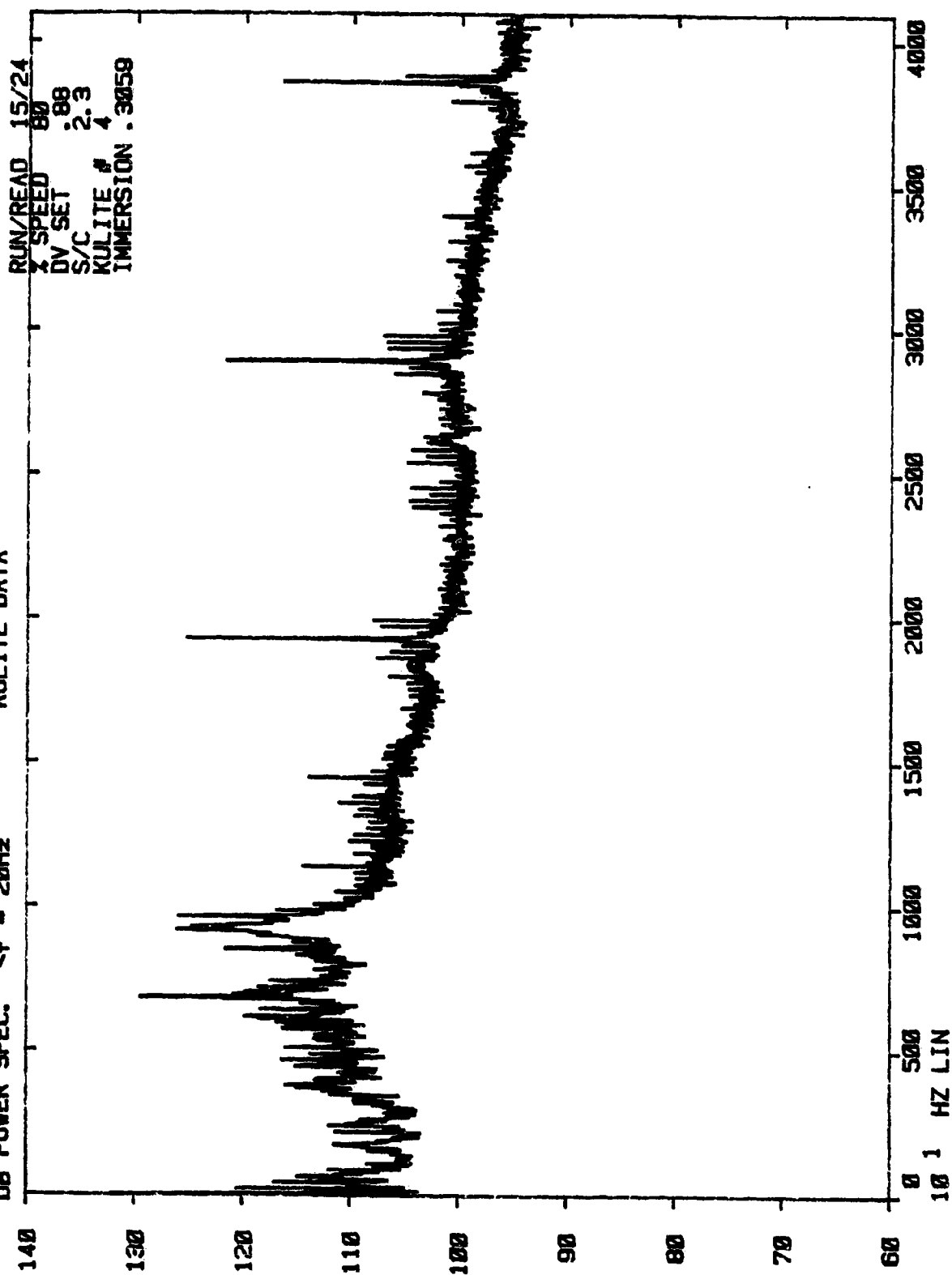
NASA V/B STUDY KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$



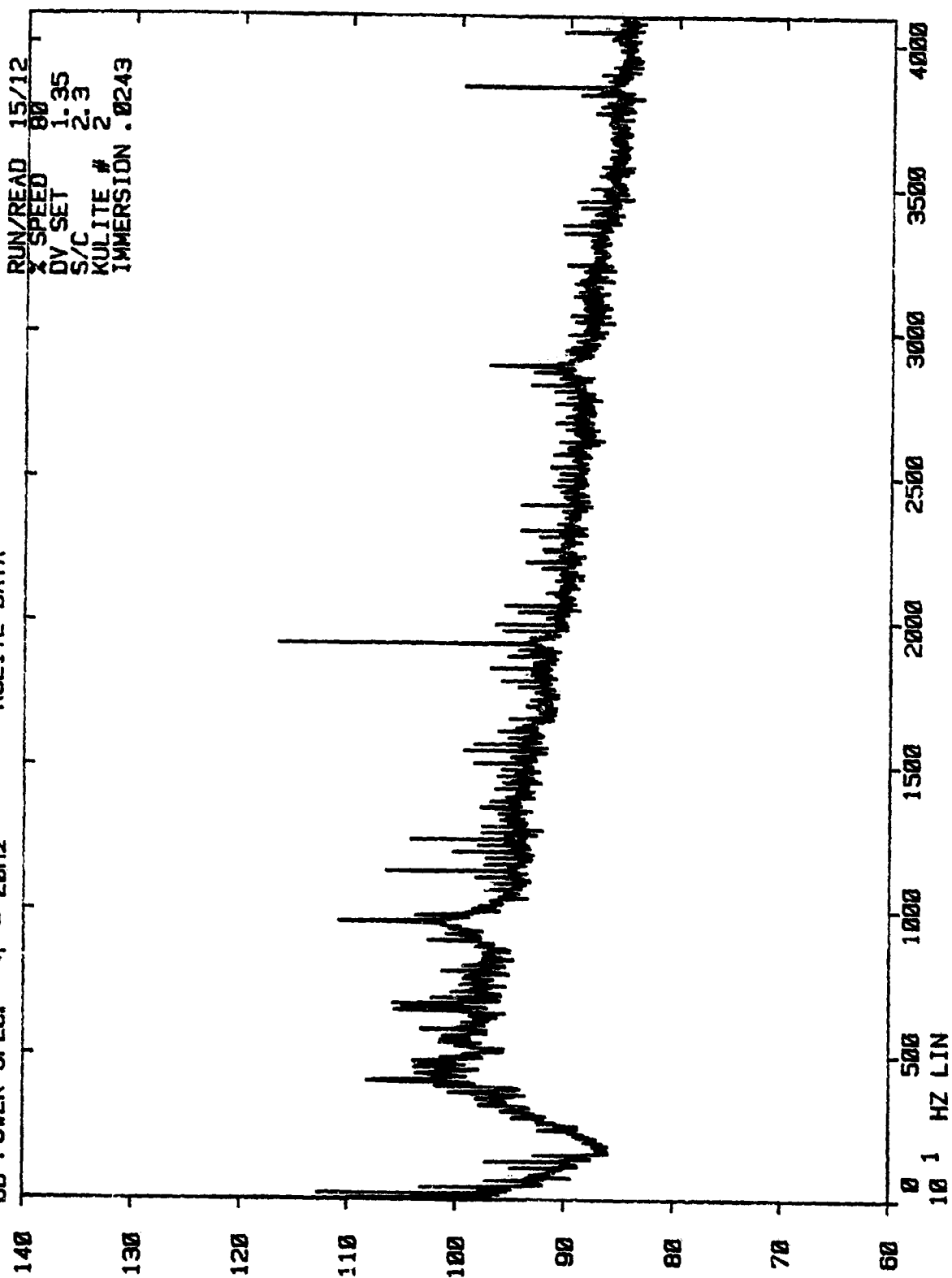
NASA V/B STUDY
KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$



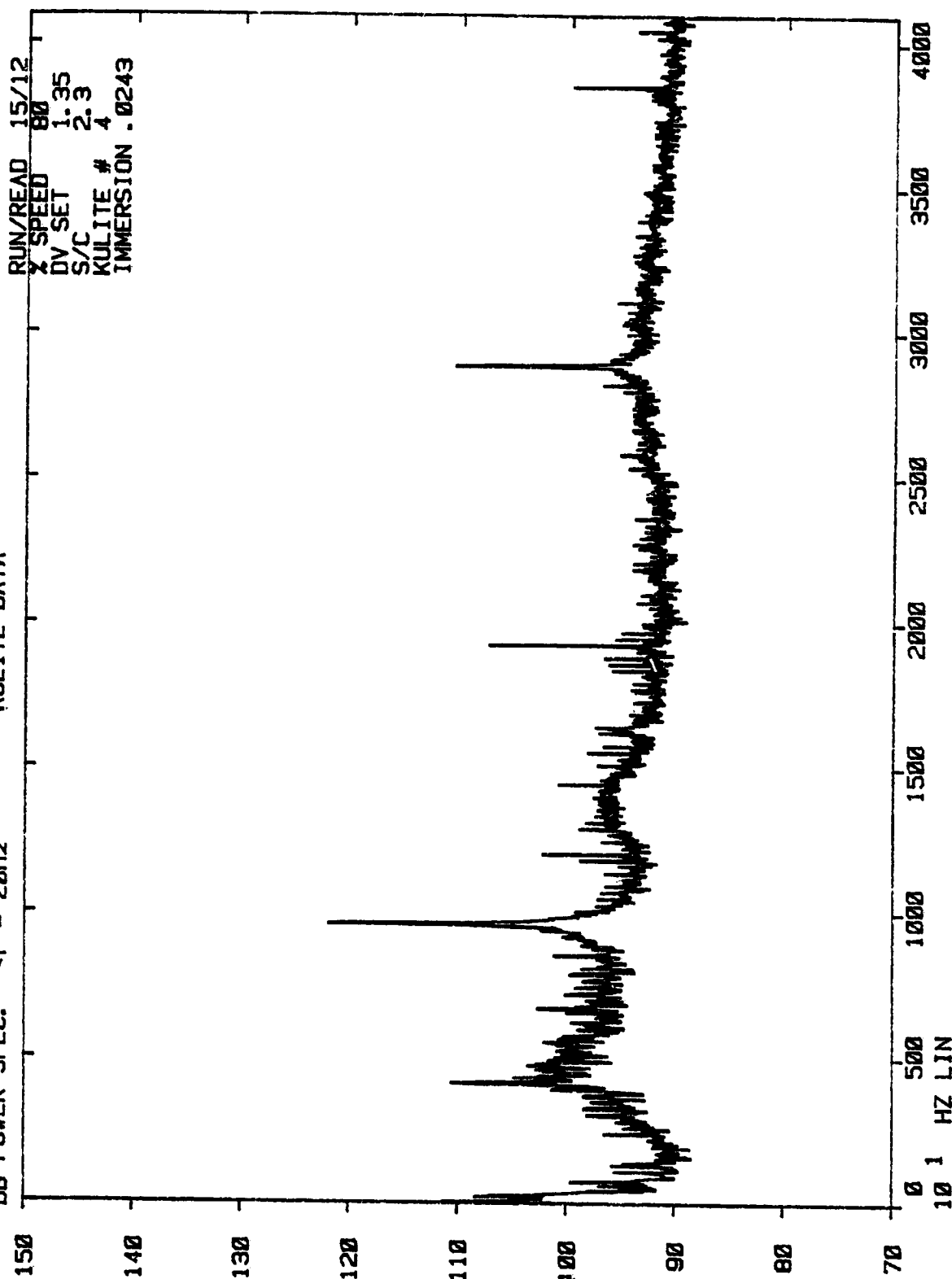
NASA V/B STUDY KULITE DATA

DB POWER SPEC. $\leq f = 20\text{Hz}$



NASA V/B STUDY KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$

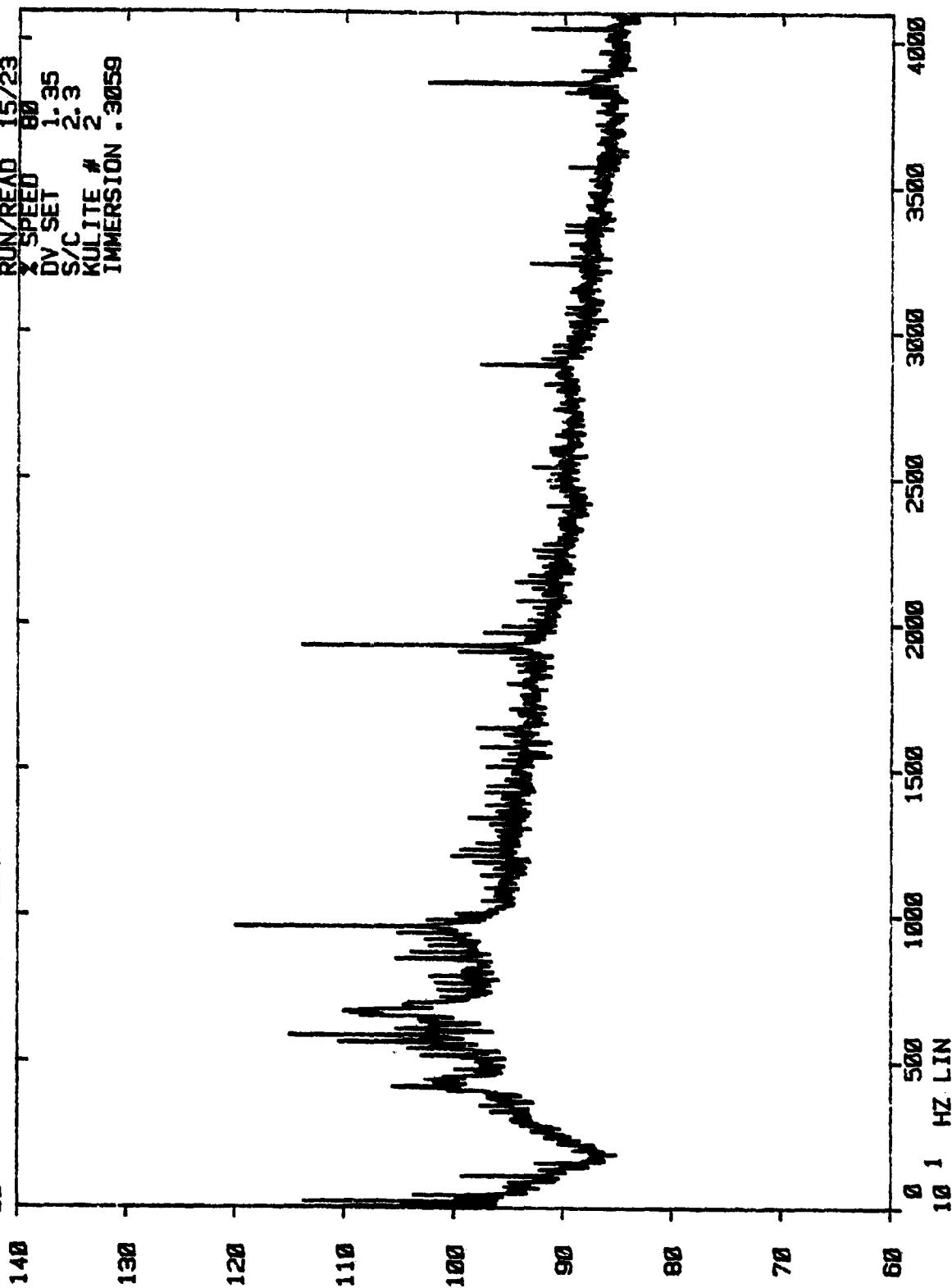


RUN/READ 15/12
X SPEED 80
DV SET 1.35
S/C 2.3
KULITE # 4
IMMERSION .0243

NASA V/B STUDY KULITE DATA

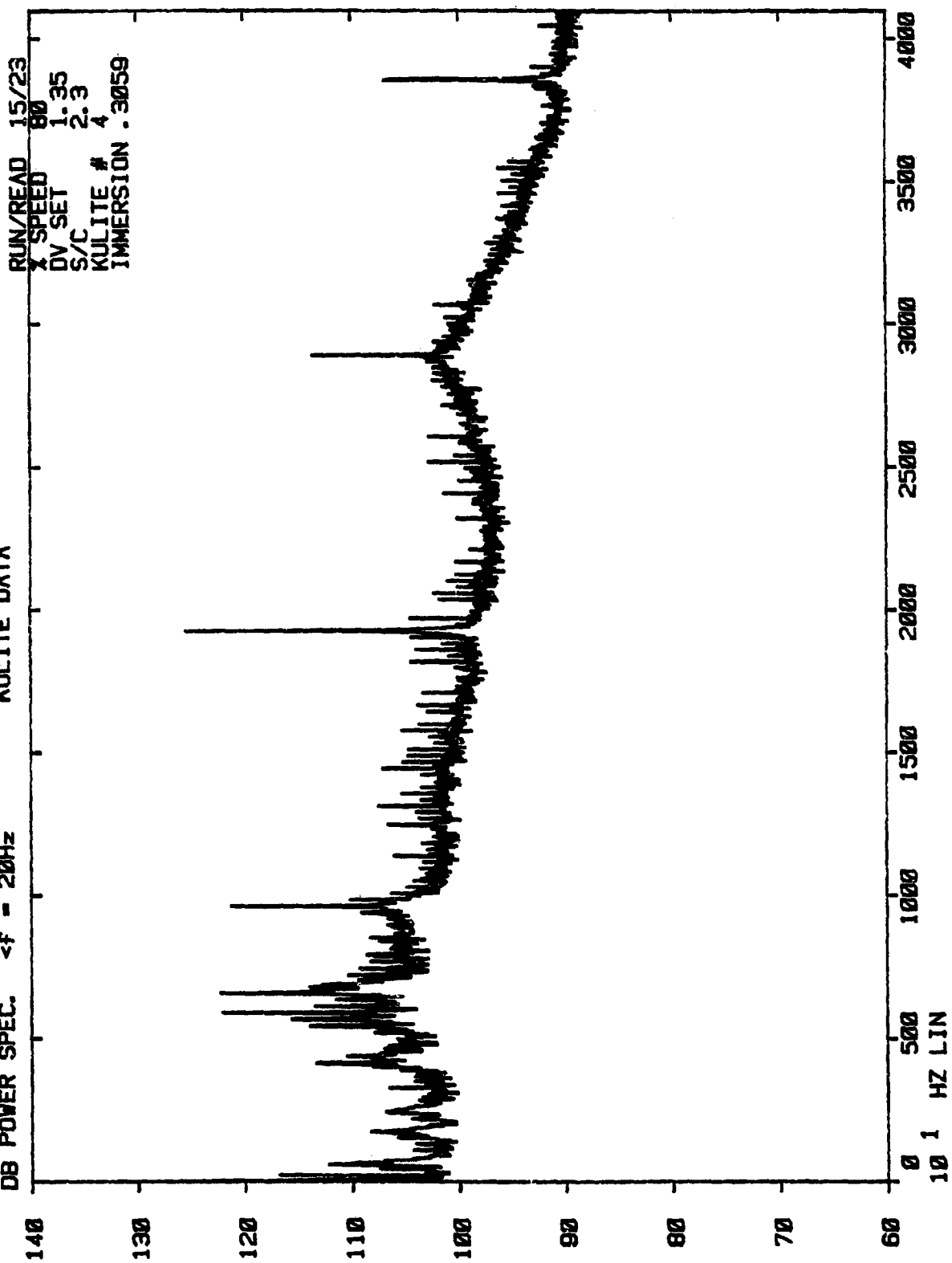
DB POWER SPEC. <f = 20Hz

RUN/READ 15/23
X SPEED 80
DV SET 1.35
S/C 2.3
KULITE # 2
IMMERSION .3059



NASA V/B STUDY KULITE DATA

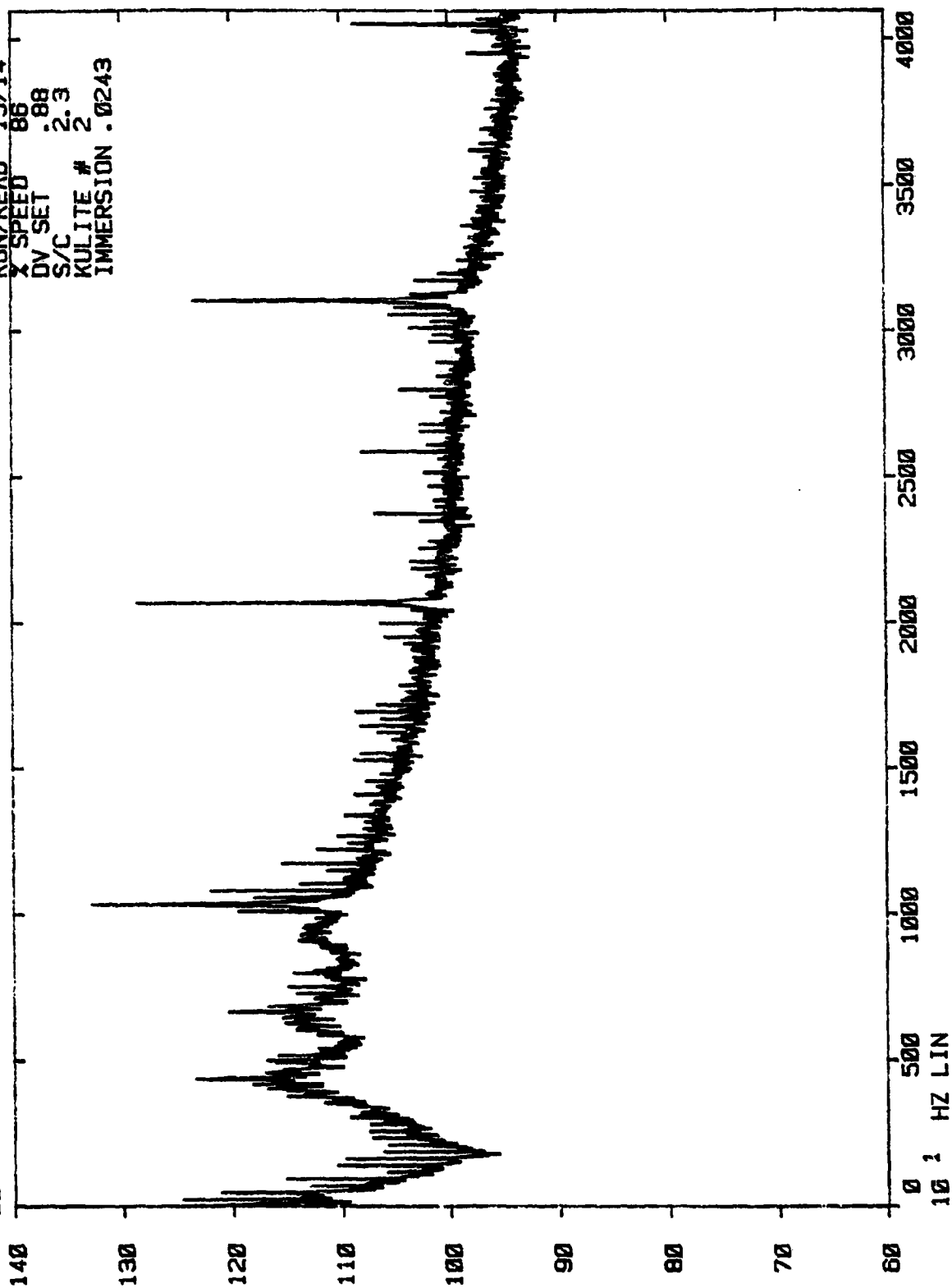
DB POWER SPEC. $< f = 20\text{Hz}$



NASA V/B STUDY KULITE DATA

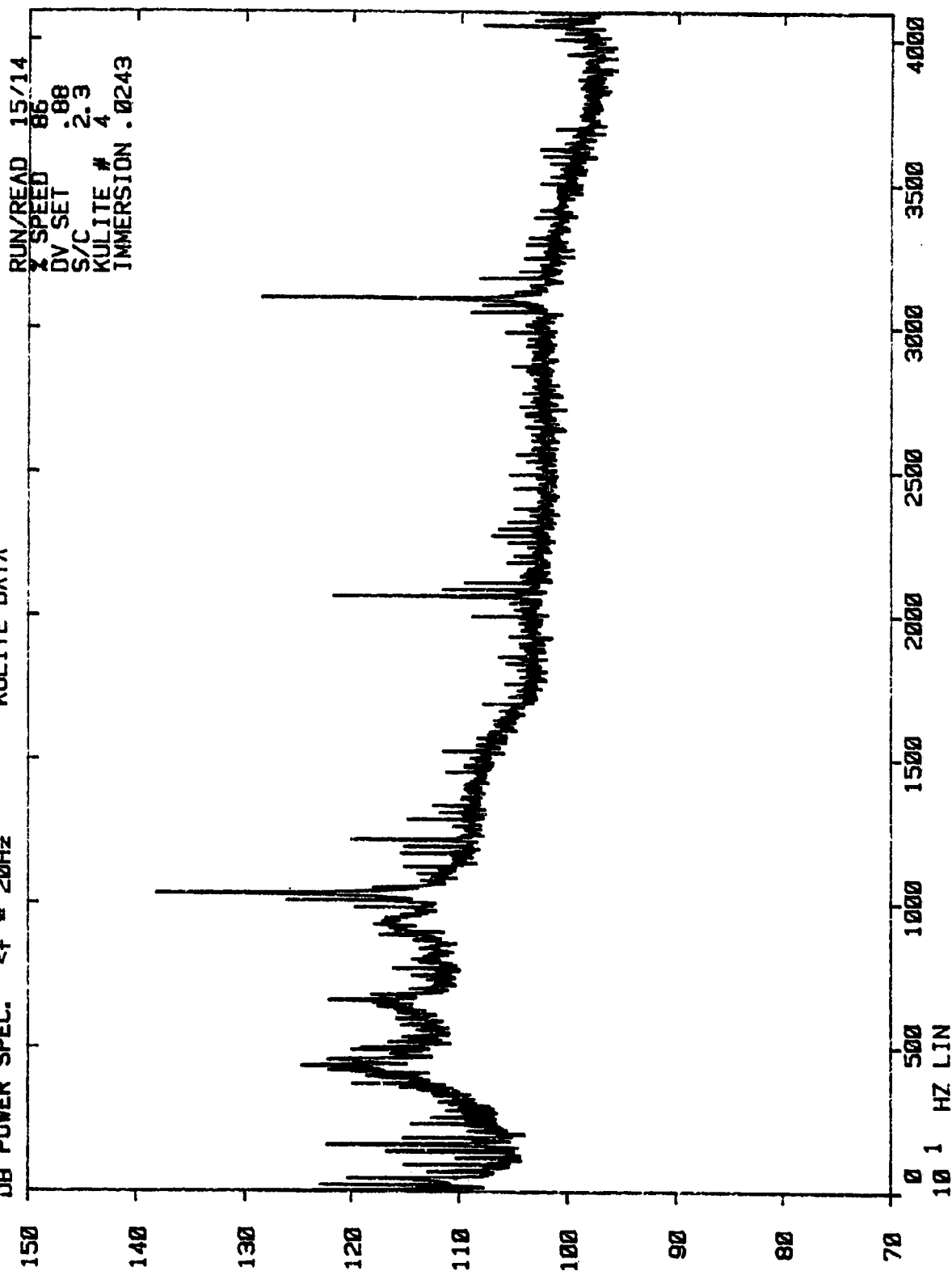
DB POWER SPEC. $<f = 20\text{Hz}$

RUN/READ 15/14
X SPEED 86
DV SET .88
S/C 2.3
KULITE # 2
IMMERSION .0243



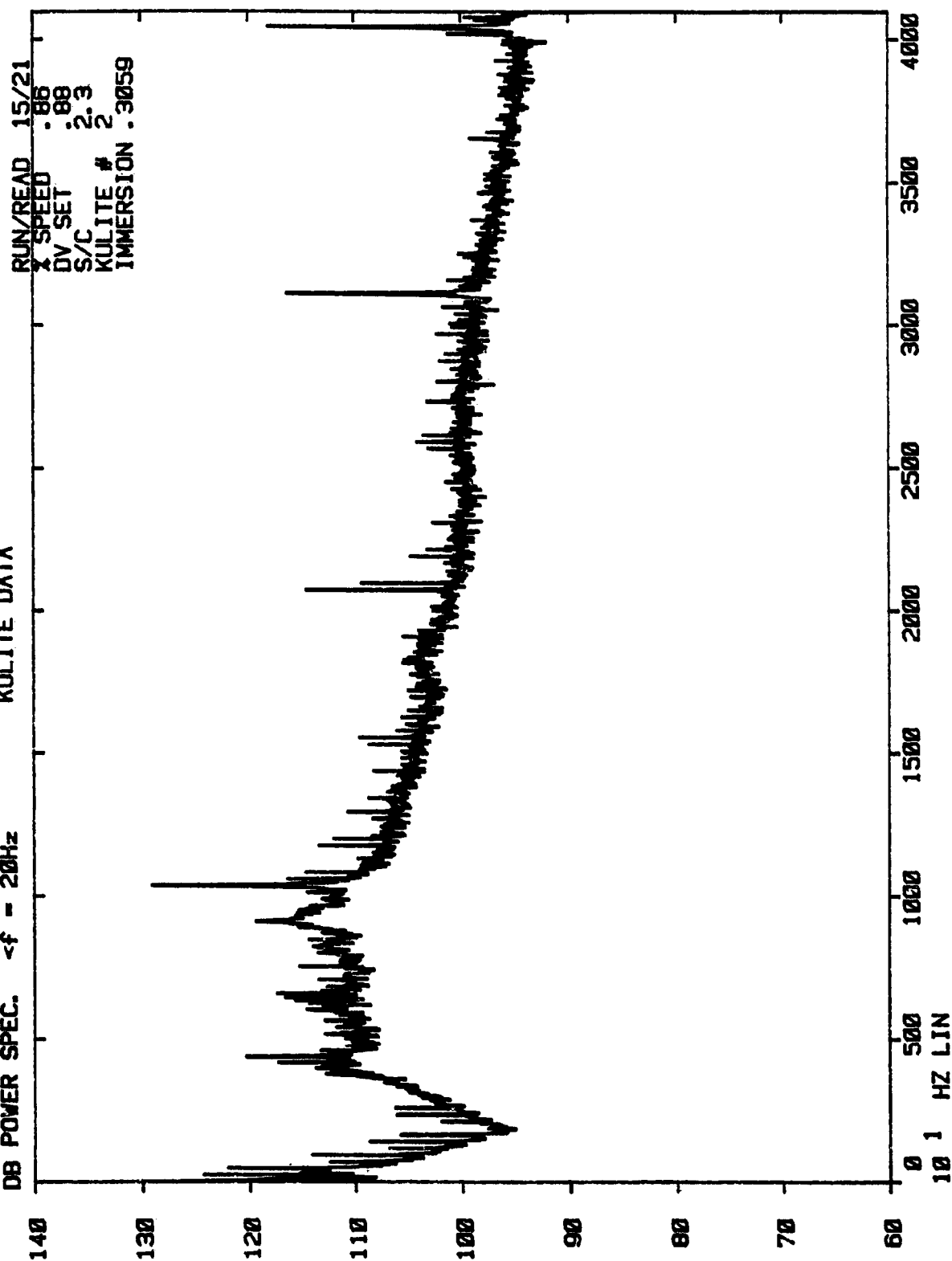
NASA V/B STUDY
KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$



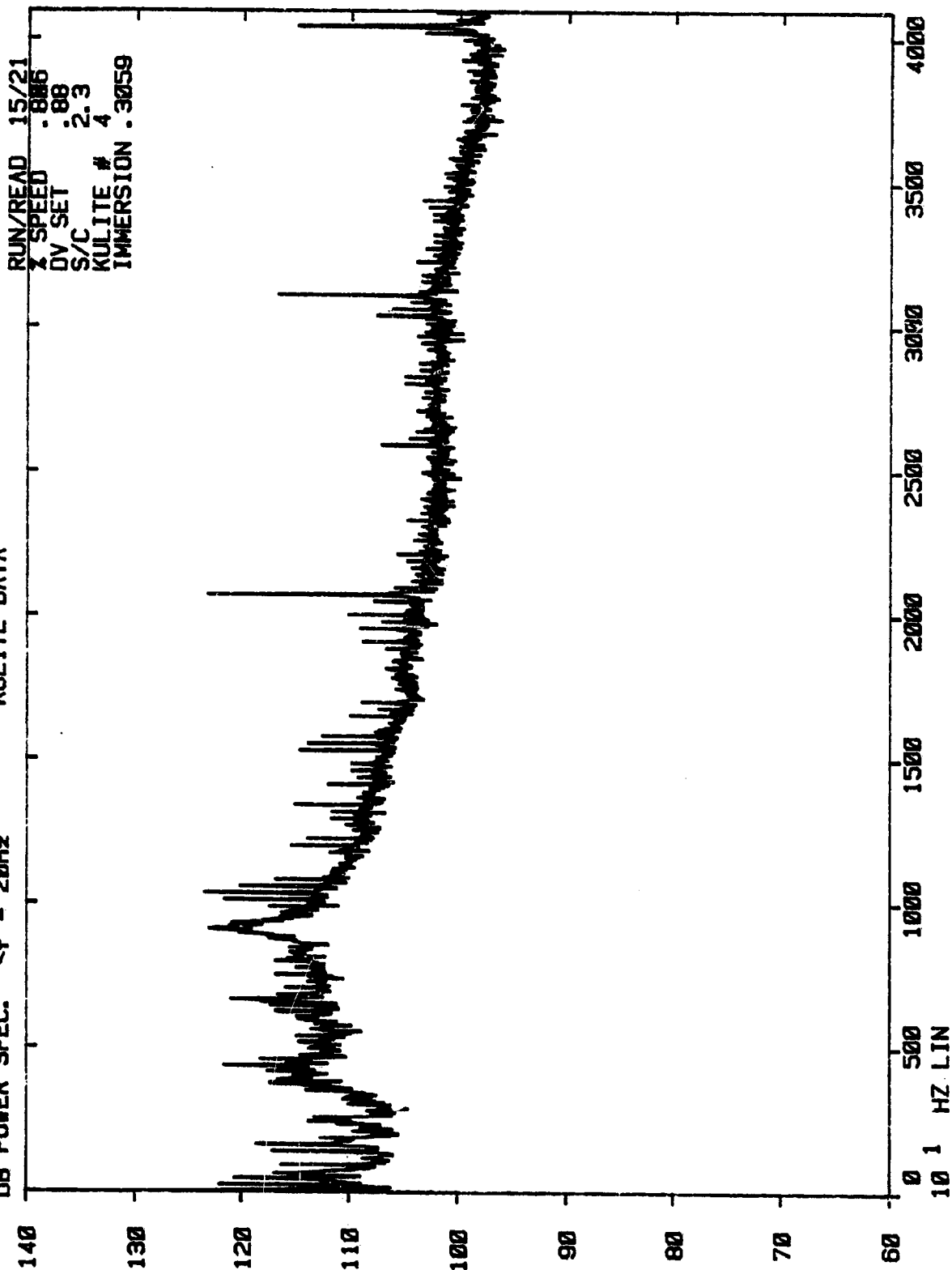
NASA V/B STUDY KULITE DATA

DB POWER SPEC. $<f = 20\text{Hz}$



NASA V/B STUDY
KULITE DATA

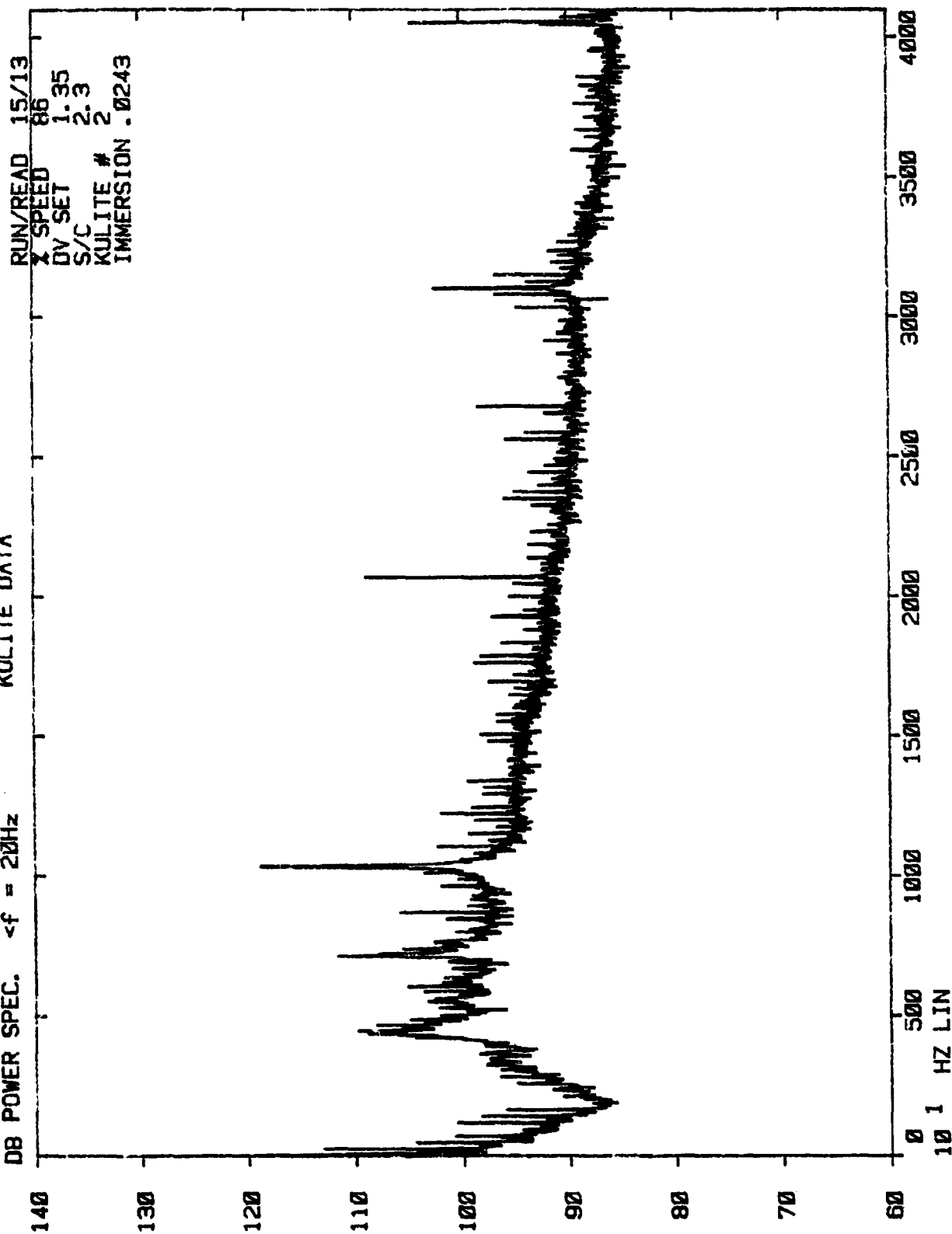
DB POWER SPEC. $< f = 20\text{Hz}$



RUN/READ 15/21
Z SPEED .886
DV SET .88
S/C 2.3
KULITE # 4
IMMERSION .3059

NASA V/B STUDY KULITE DATA

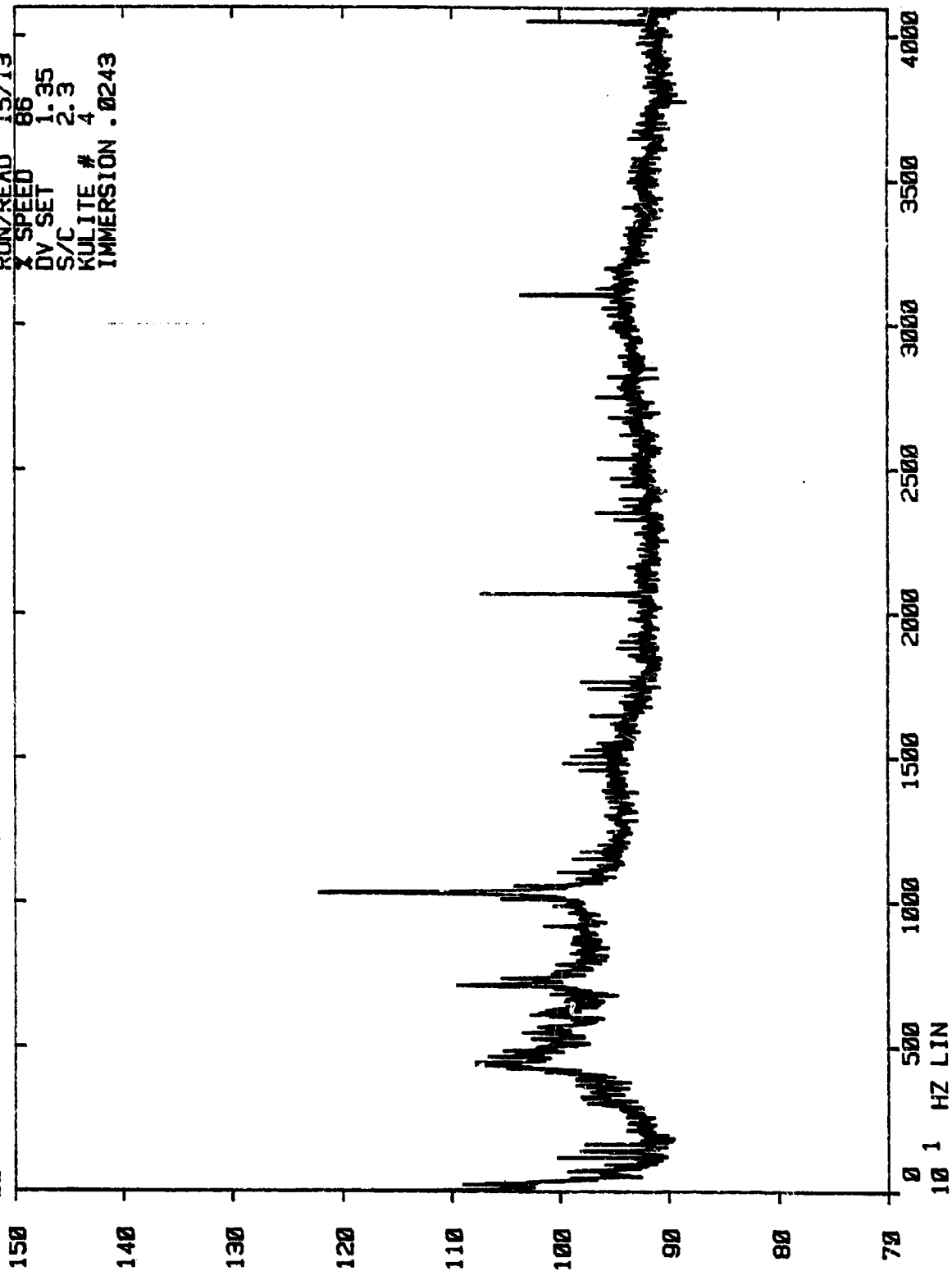
DB POWER SPEC. $\angle f = 20\text{Hz}$



NASA V/B STUDY
KULITE DATA

DB POWER SPEC. <f = 20Hz

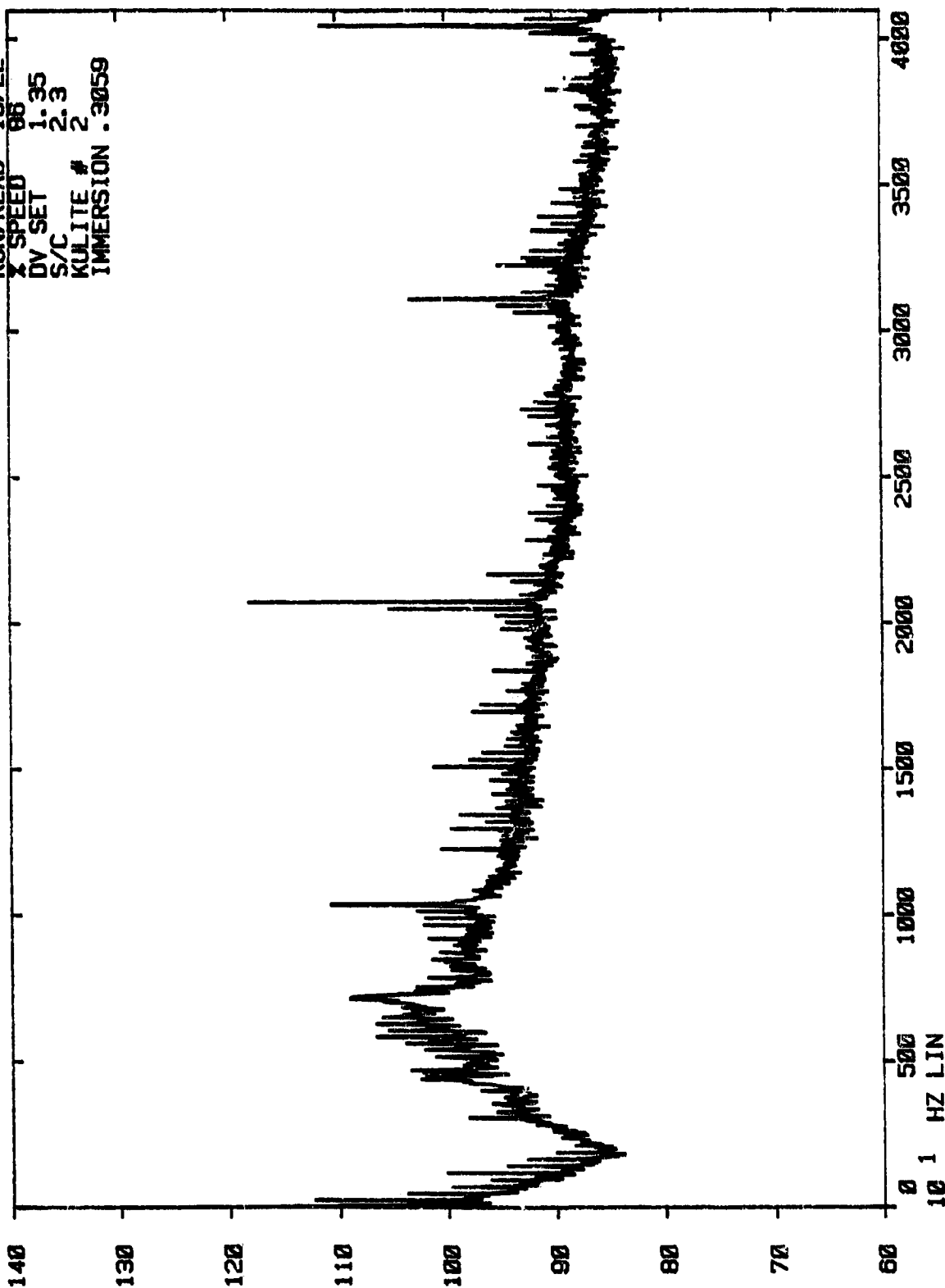
RUN/READ 15/13
X SPEED 86
DV SET 1.35
S/C 2.3
KULITE # 4
IMMERSION .0243



NASA V/B STUDY KULITE DATA

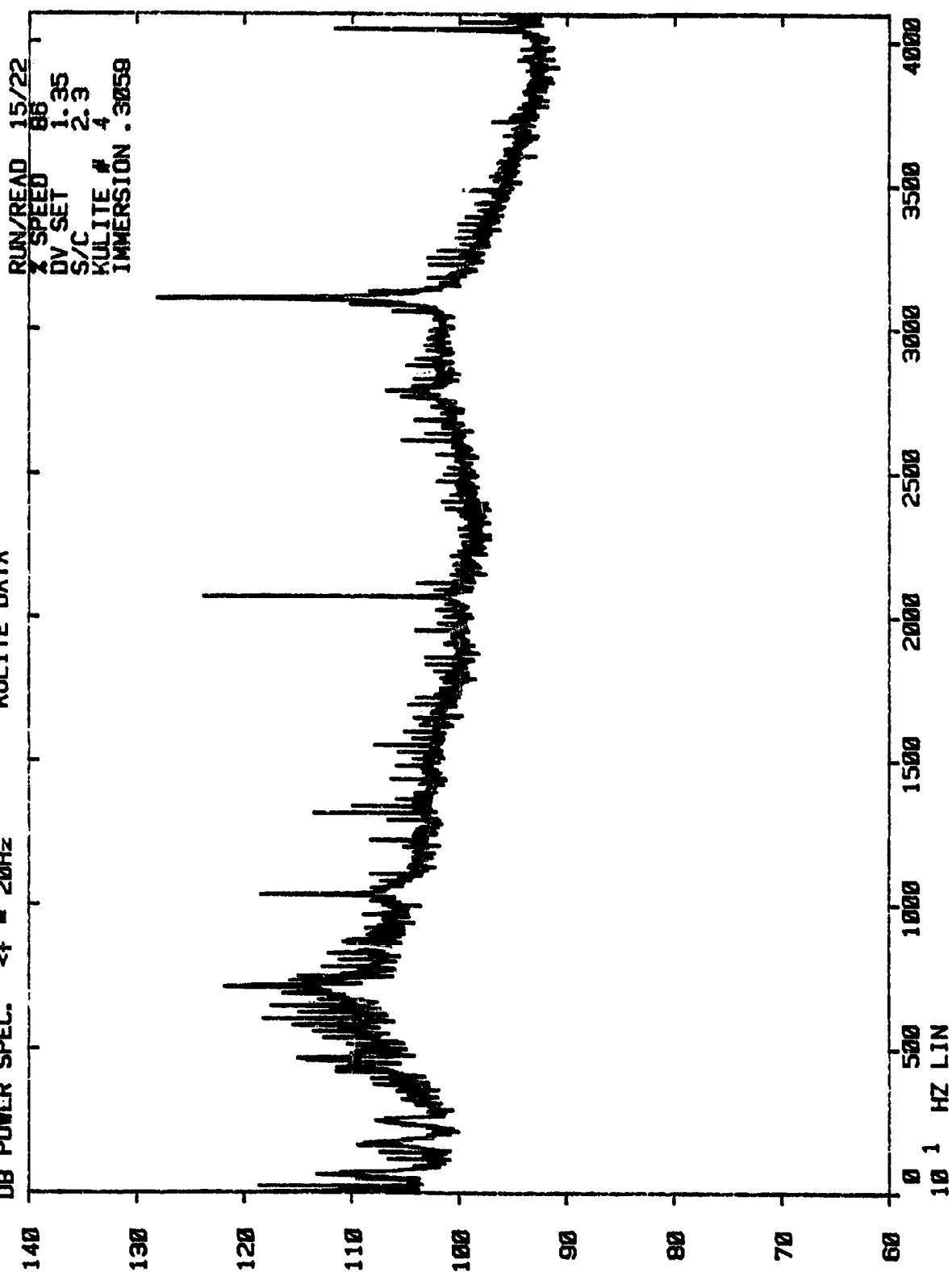
DB POWER SPEC. $<f = 20\text{Hz}$

RUN/READ 15/22
X SPEED 88
DV SET 1.35
S/C 2.3
KULITE # 2
IMMERSION .3059



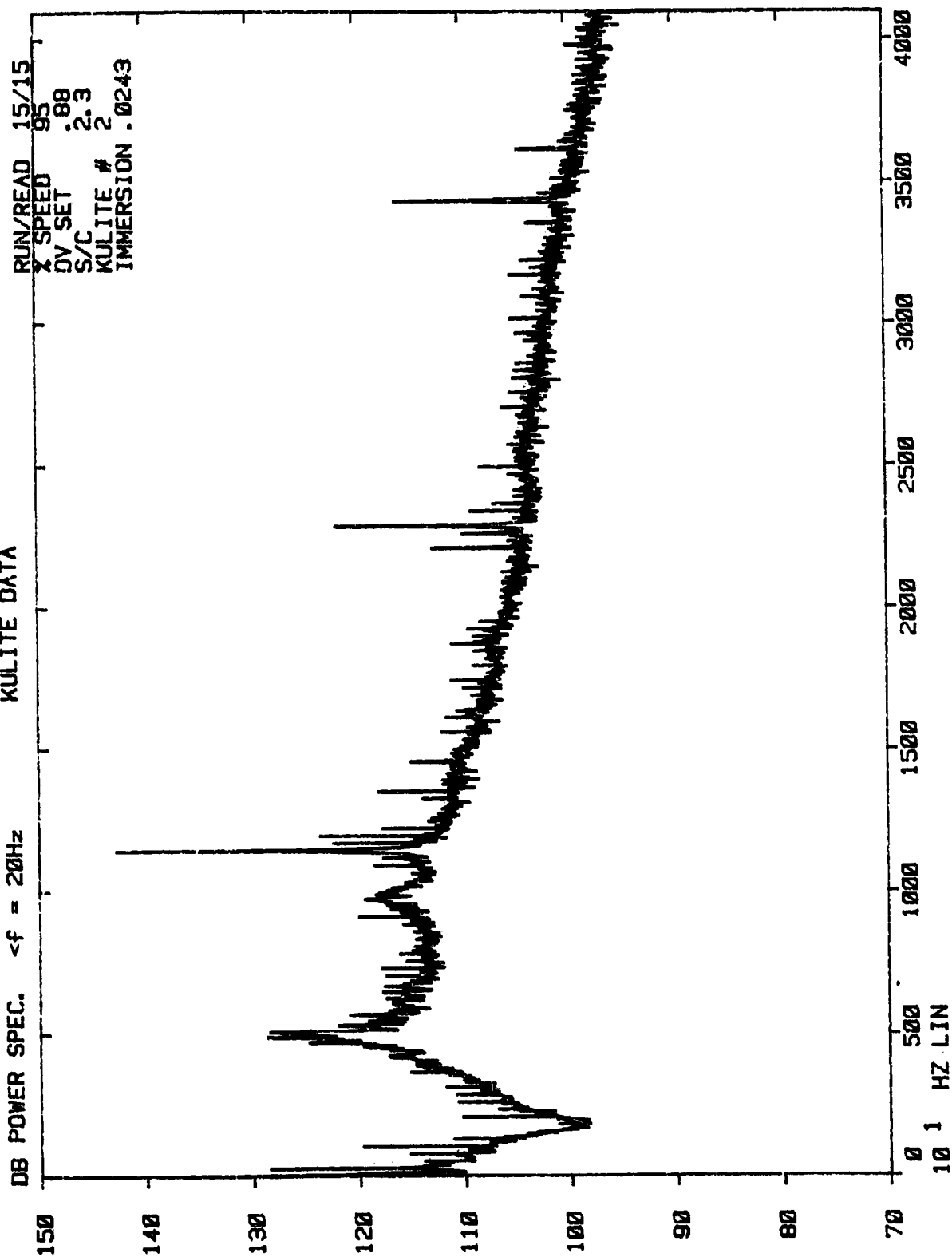
NASA V/3 STUDY
KULITE DATA

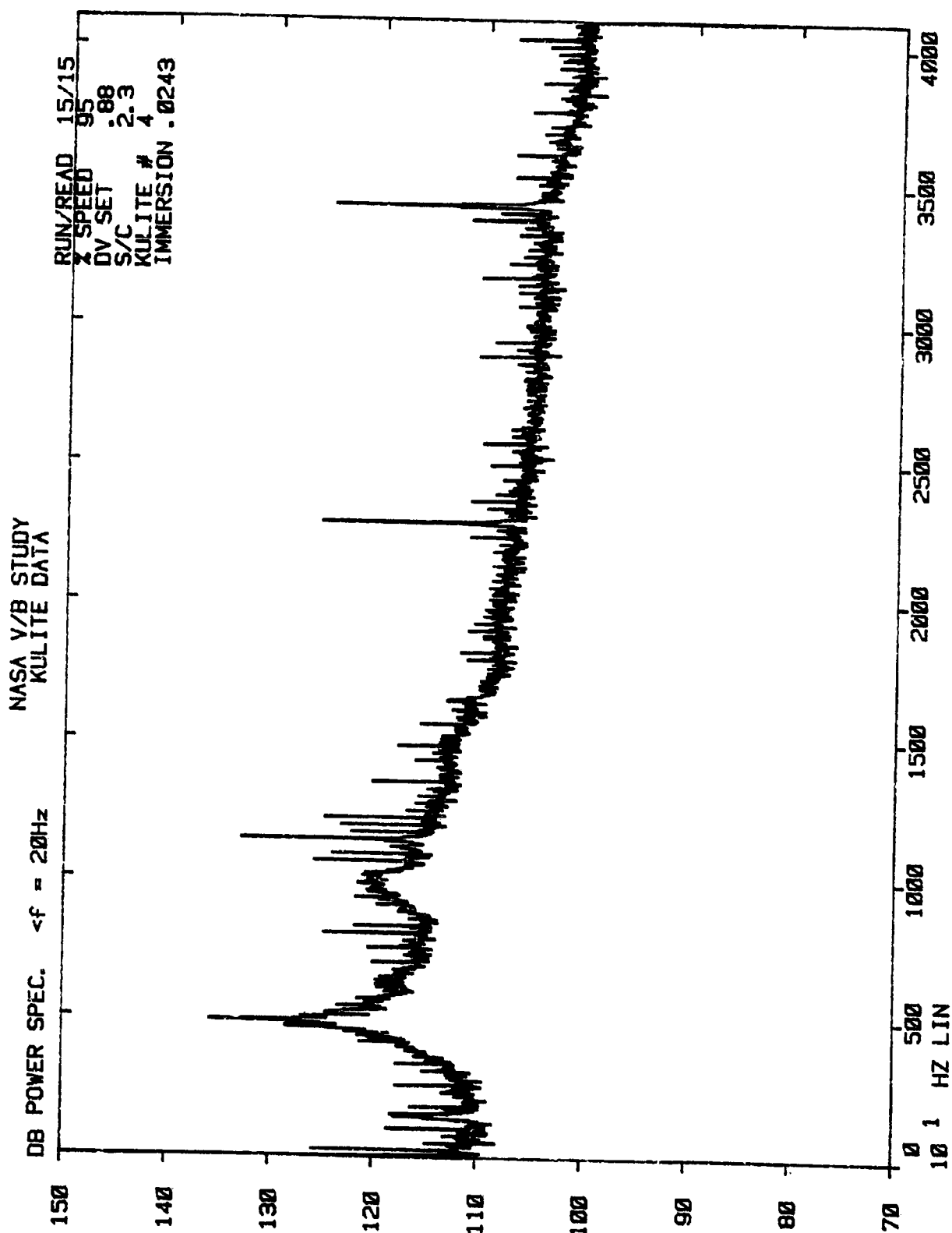
DB POWER SPEC. $<f = 20\text{Hz}$



NASA V/B STUDY KULITE DATA

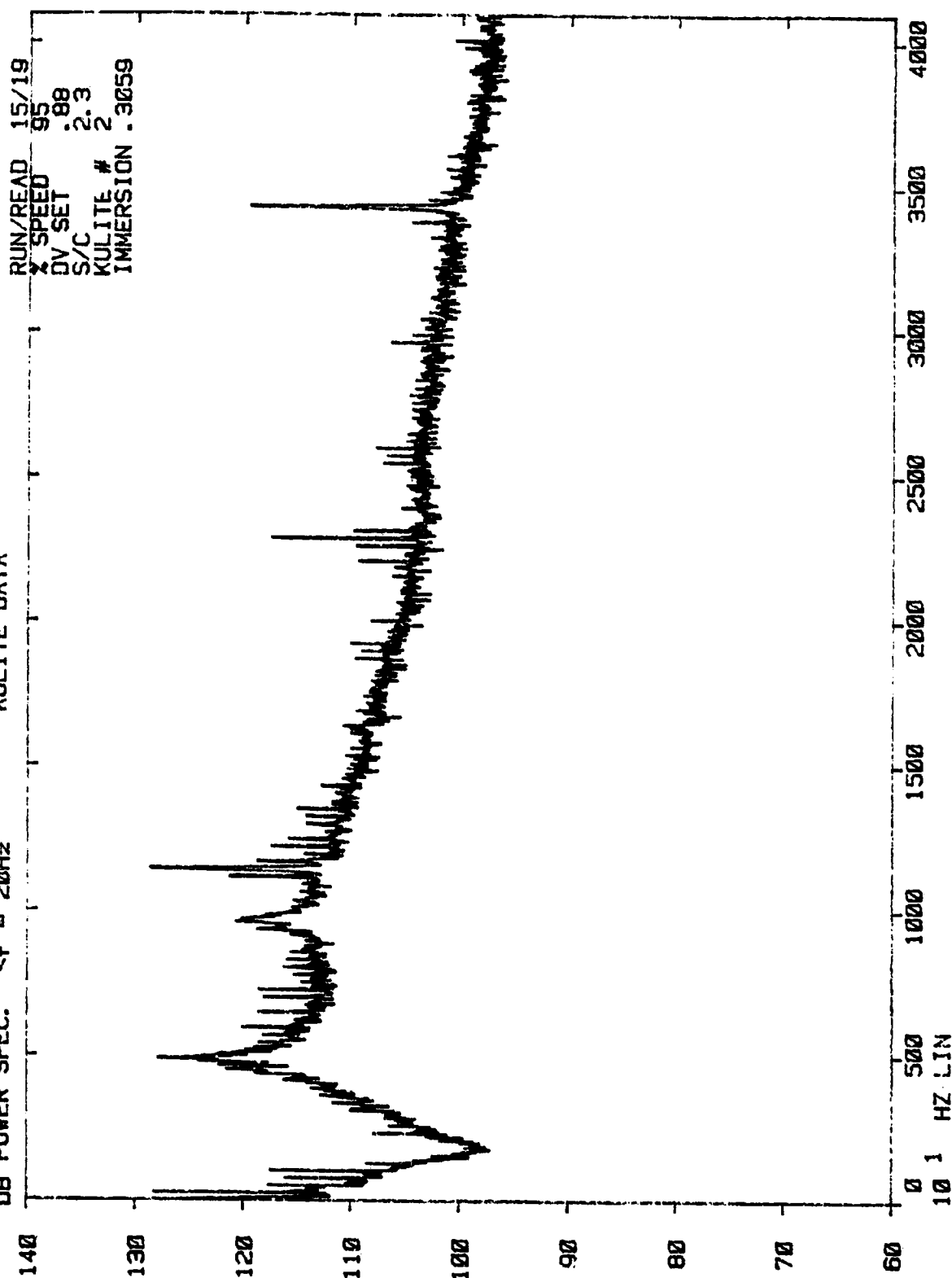
DB POWER SPEC. $\leq f = 20\text{Hz}$





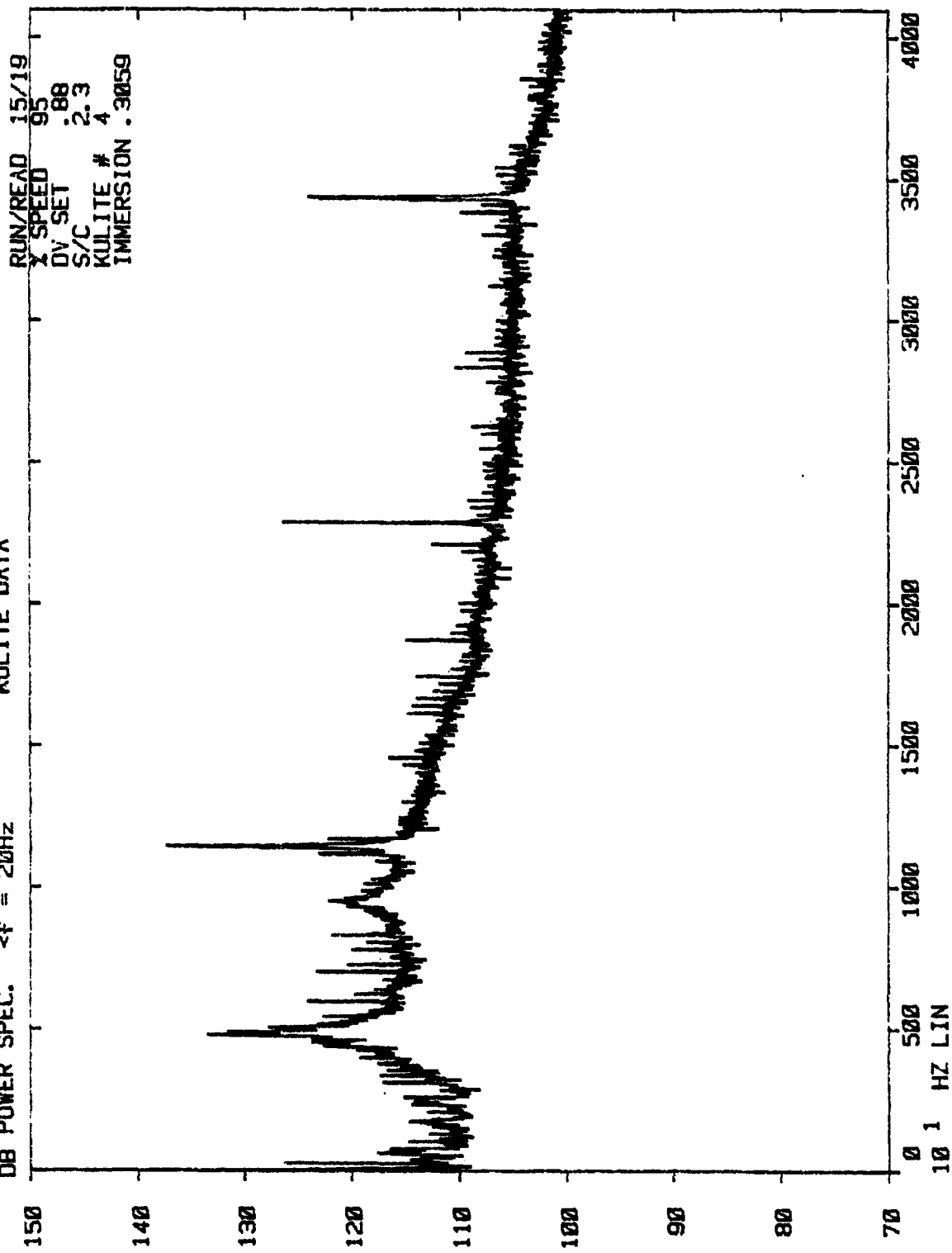
NASA V/B STUDY KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$



NASA V/B STUDY
KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$



NASA V/B STUDY KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$

RUN/READ 15/16

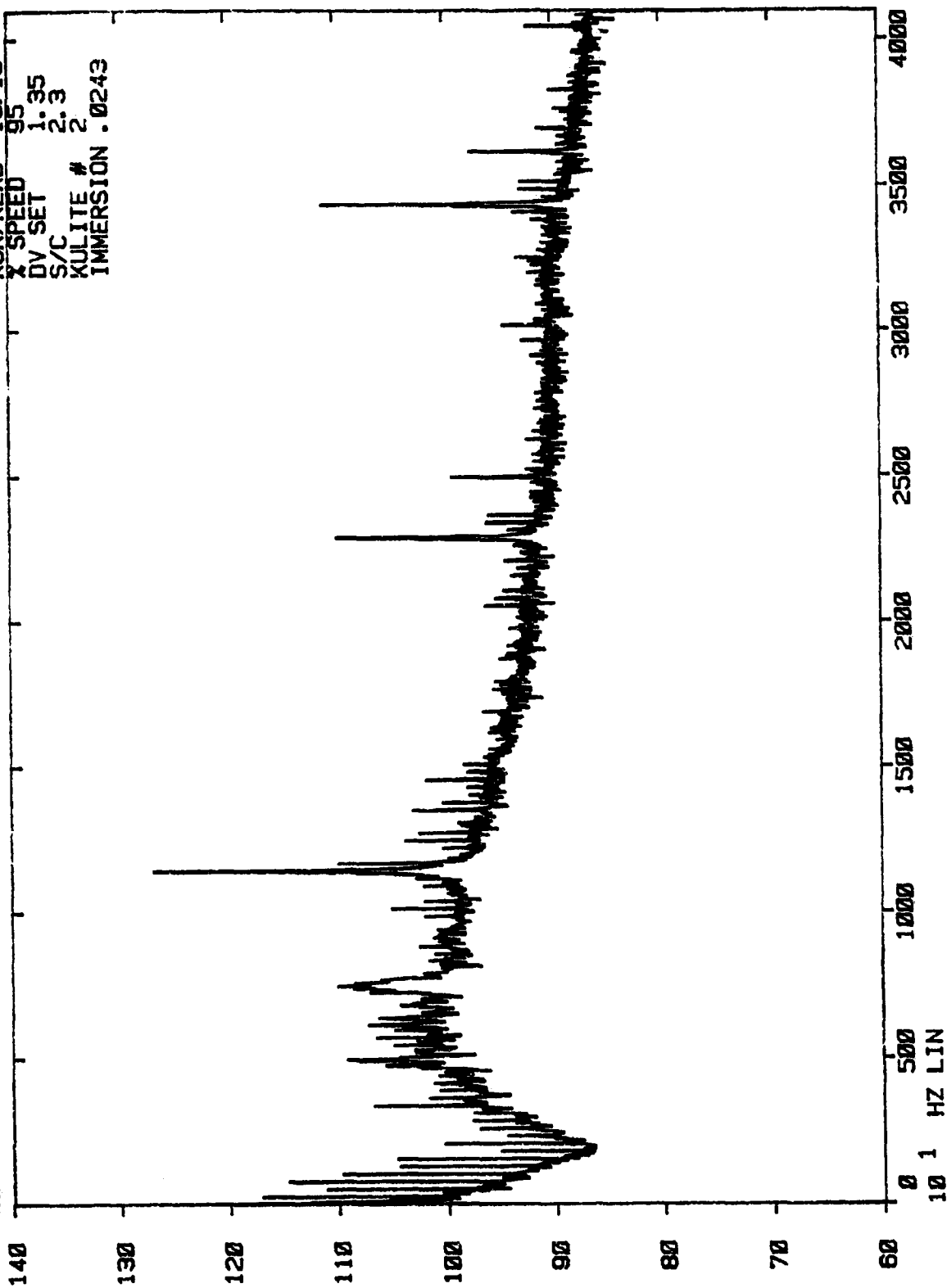
X SPEED 95

DV SET 1.35

S/C 2.3

KULITE # 2

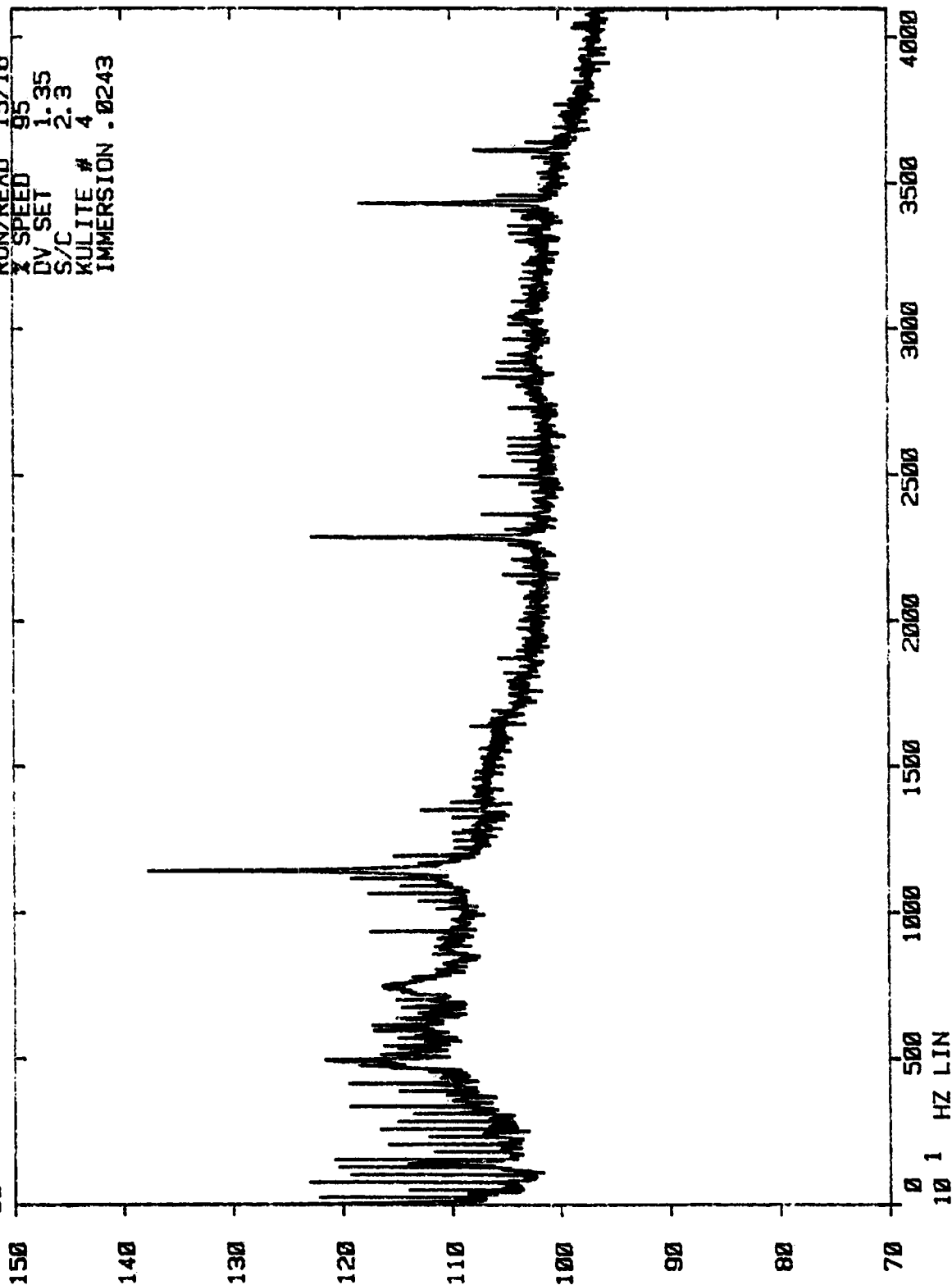
IMMERSION .0243



NASA V/B STUDY KULITE DATA

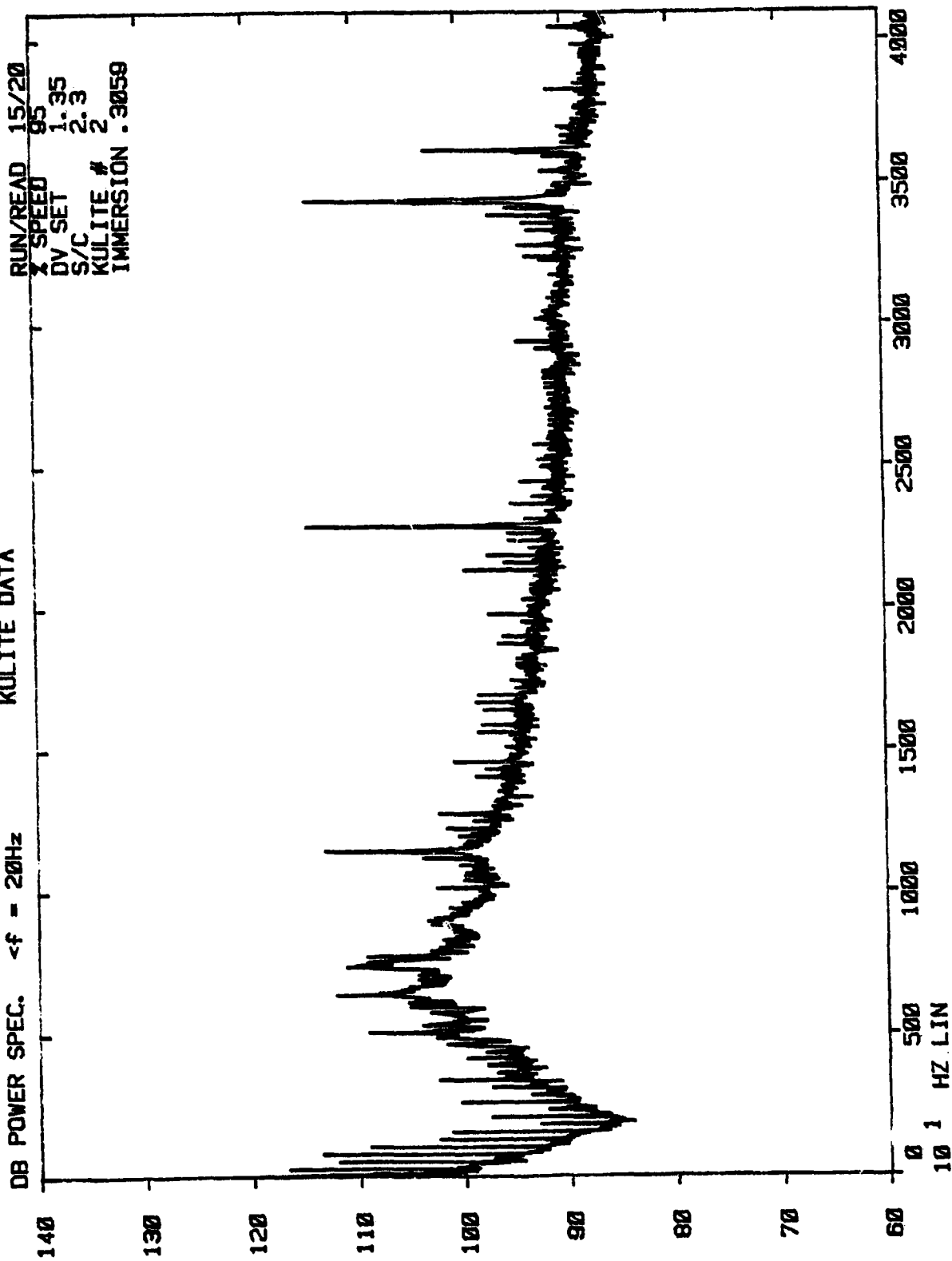
DB POWER SPEC. $\leq f = 20\text{Hz}$

RUN/READ 15/16
X SPEED 95
DV SET 1.35
S/C 2.3
KULITE # 4
IMMERSION .0243



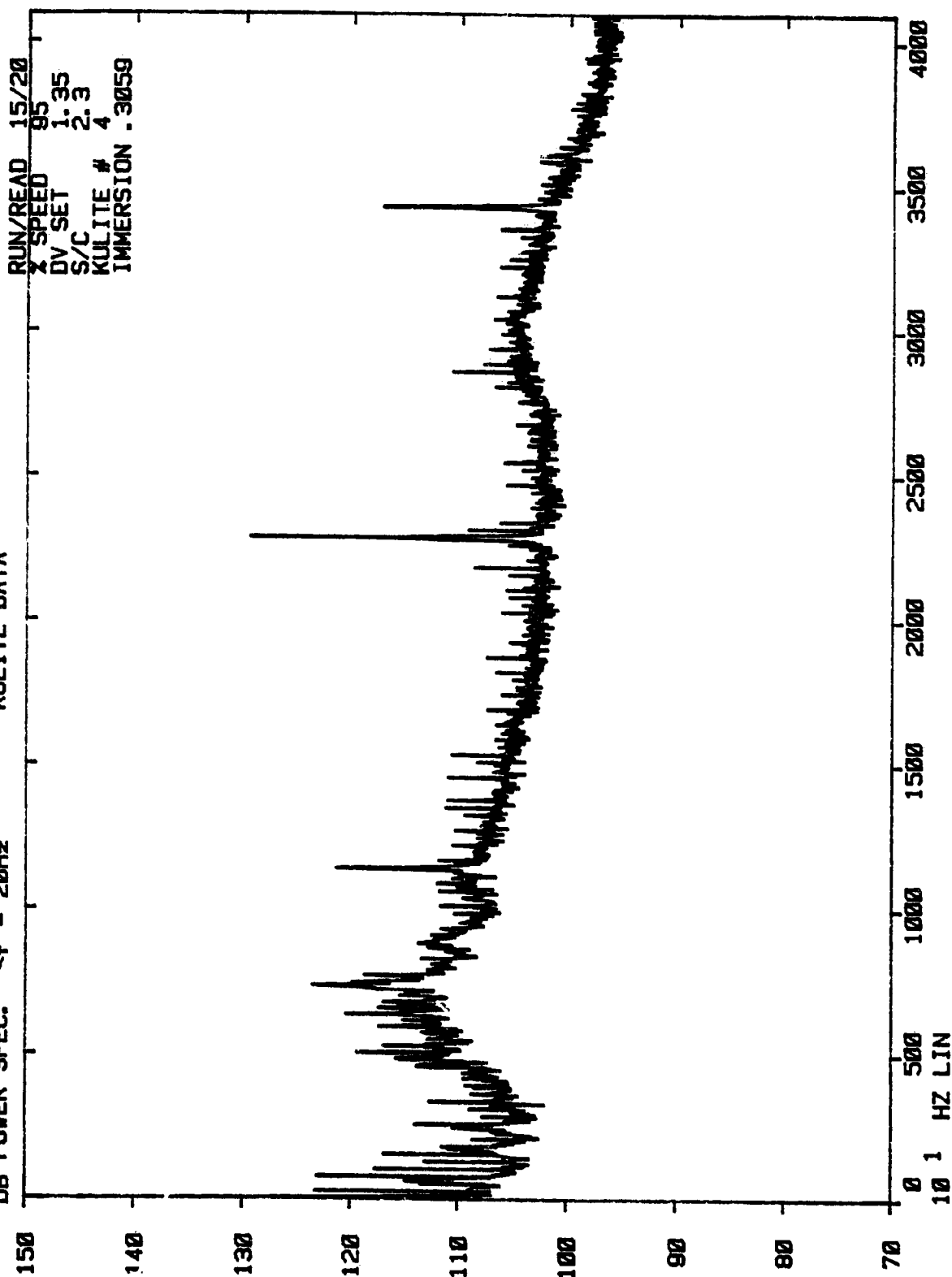
NASA V/B STUDY
KULITE DATA

DB POWER SPEC. $<f = 20\text{Hz}$



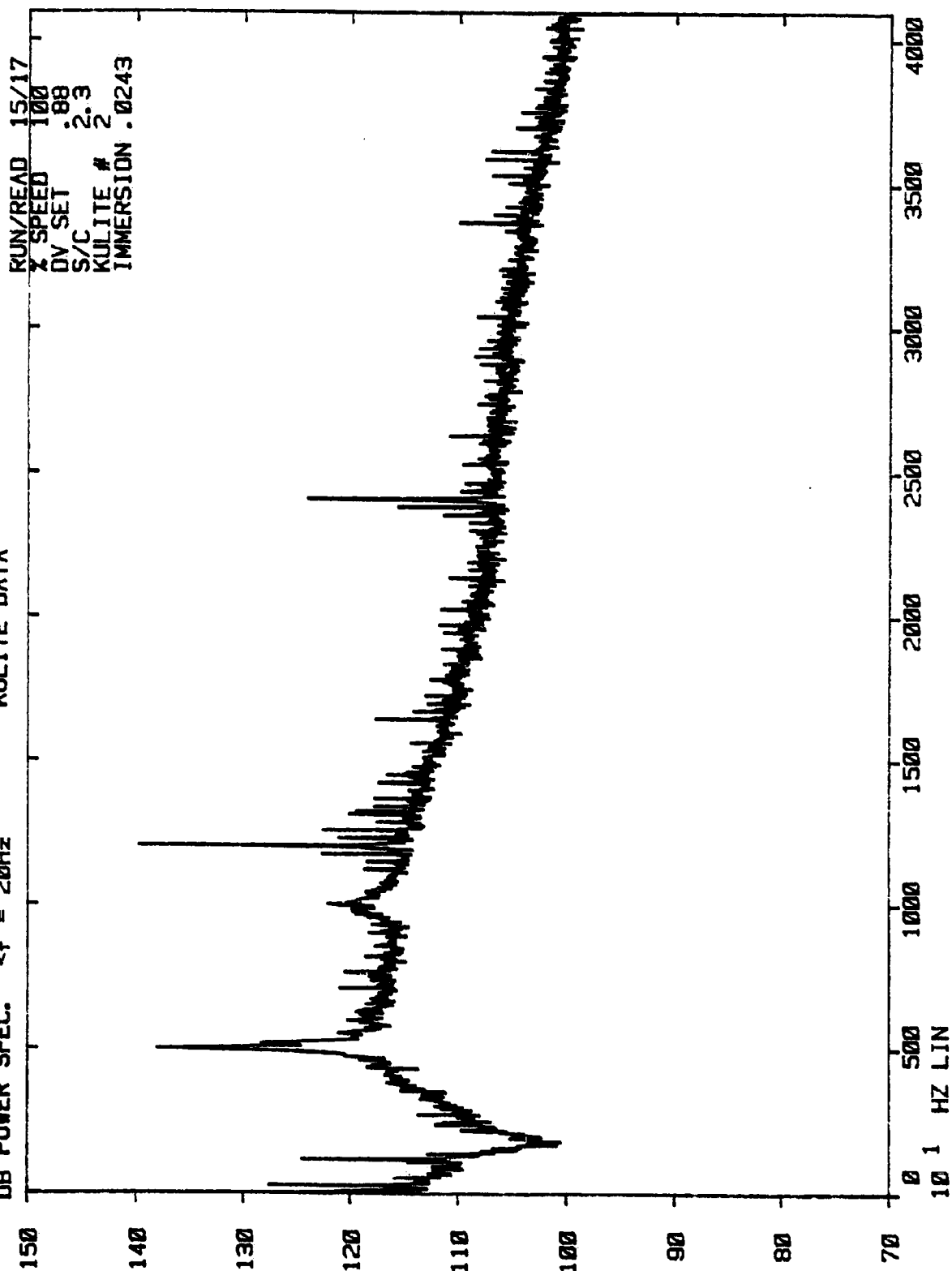
NASA V/B STUDY KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$



NASA V/B STUDY KULITE DATA

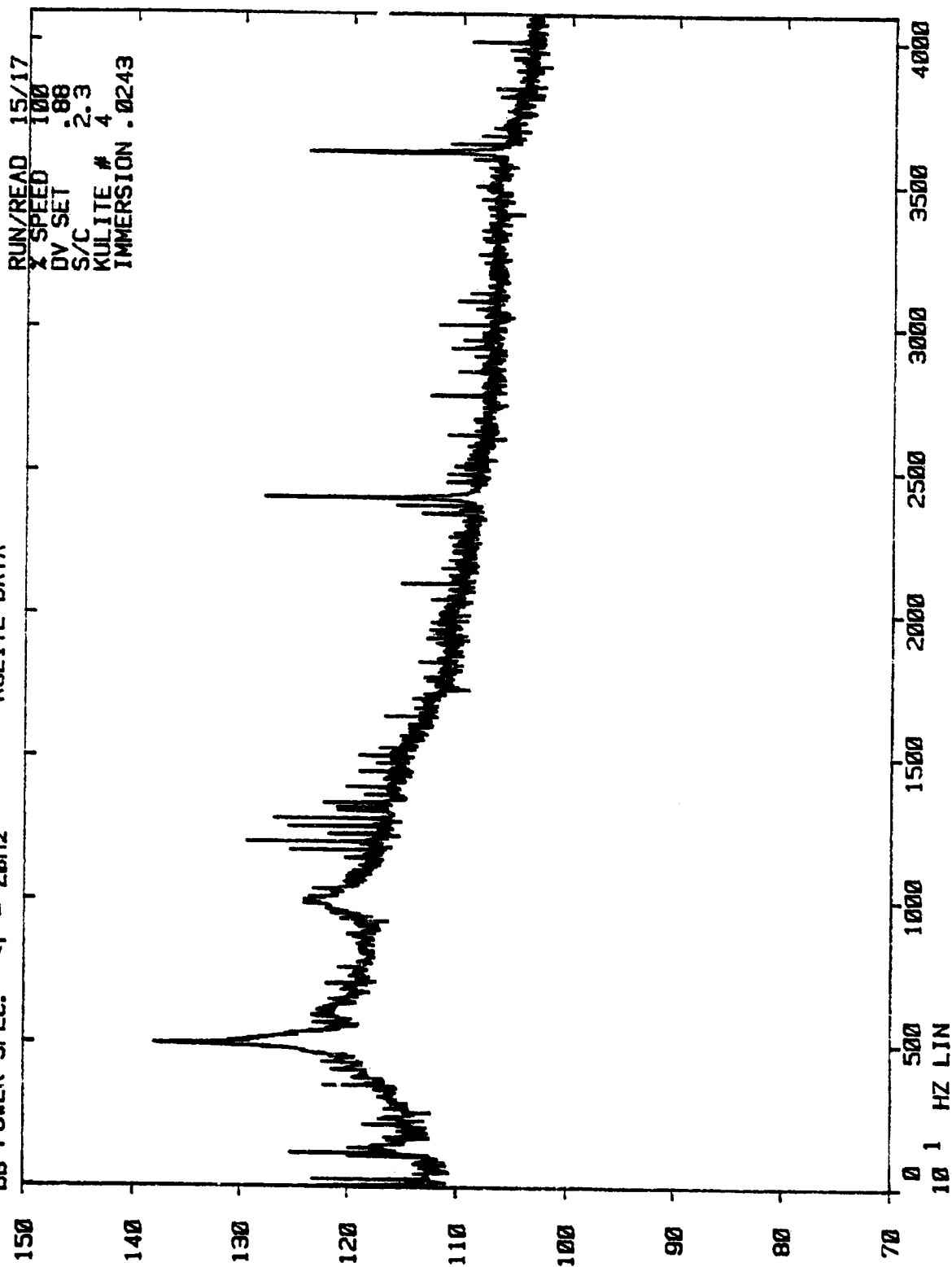
DB POWER SPEC. $\Delta f = 20\text{Hz}$



RUN/READ 15/17
X SPEED 100
DV SET .88
S/C 2.3
KULITE # 2
IMMERSION .0243

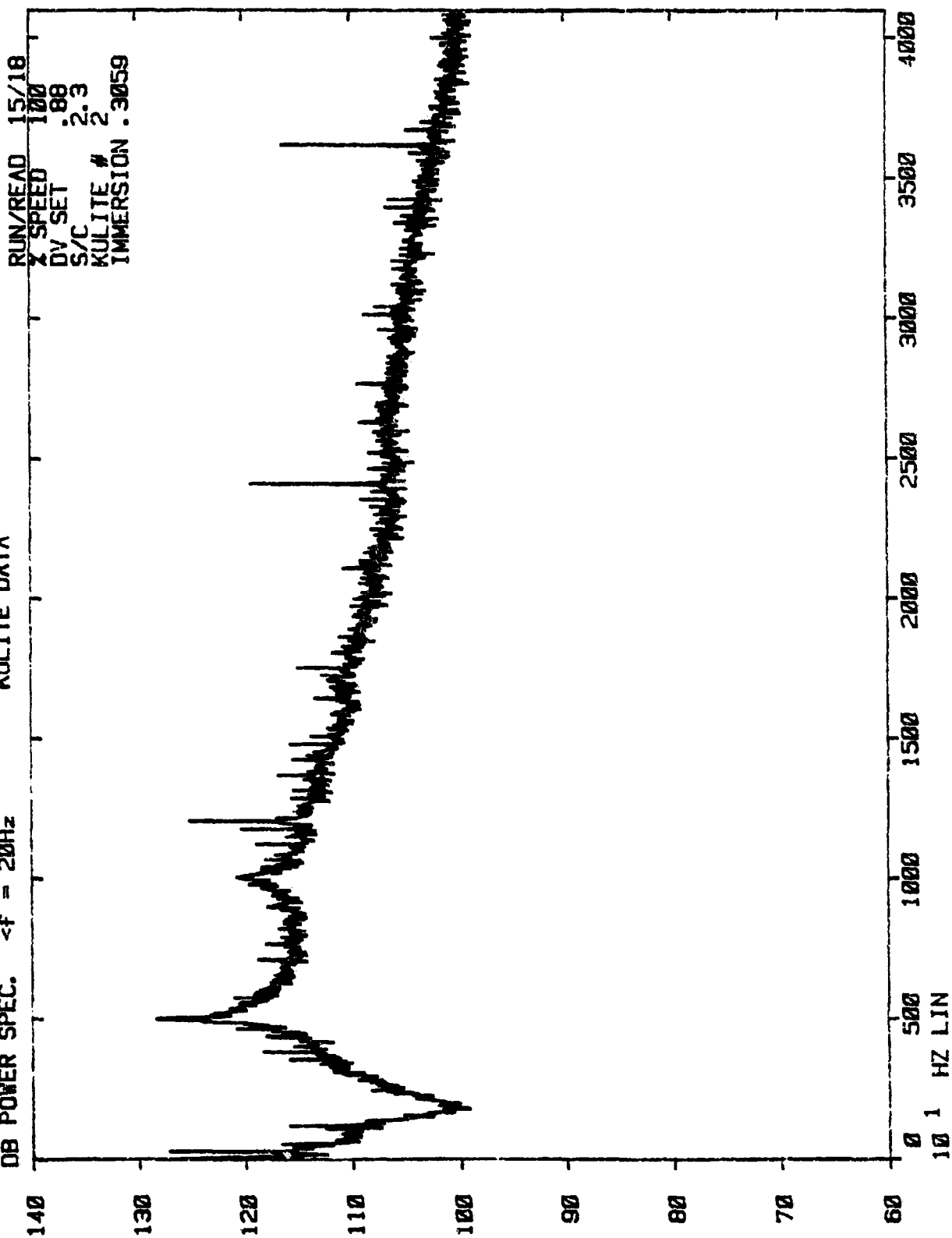
NASA V/B STUDY
KULITE DATA

DB POWER SPEC. $<f = 20\text{Hz}$



NASA V/B STUDY
KULITE DATA

DB POWER SPEC. $\Delta f = 20\text{Hz}$



NASA V/B STUDY
KULITE DATA

